



Appendix C
Detailed Mass Balance Sheets







Appendix C

C1. DETAILED MASS BALANCE SHEETS

For clarity and convenience of use, detailed mass balance data spreadsheets for each option are provided in the accompanying Appendixes A and C Spreadsheets volume. However, the data is being validated and is subject to change. The spreadsheets supplied include:

Vitrification Options

- In situ
- Ex situ

Thermal Desorption

- On/off-Site
- On-Site
- Off-Site

Chemical Oxidation/Stabilization

- In situ COG
- Ex situ COG

C2. ASSUMPTIONS

The following assumptions were used in developing the spreadsheets in this appendix:

- The treatment alternatives flow sheet represents a complete solution, with all secondary waste streams and stack emissions complying with applicable regulations.^h
- Treatment of the tanks will be based on the contents of the waste. Separate treatment trains for solid and liquid are not a requirement, although treatment alternatives may allow for some level of decant steps.
- Treatment of the main organic constituents (TCE, PCE, PCB, and BEHP) in a given treatment alternative will be robust, relative to the non-detect organics as to require material balance tracking of every non-detect specie that exceeds the Universal Treatment Standard.
- The concentrations of the CFTs in the primary and secondary wastes will be tracked to the final waste form following all the necessary treatments. The concentration in the final waste form will

h. For gaseous releases, not all of the treatment alternatives will be held to the same standard, i.e. some alternatives by the nature of contamination destruction will be held by the stringent MACT requirements. The specific regulatory status will be spelled out in each treatment alternative section.

be lower than the treatment standard (TS) concentration when the TS is based on total concentration. For the contaminants that have to meet a toxicity characteristic leaching procedure (TCLP) TS, suitable process knowledge will be required for any CFT with a total concentration exceeding the divide-by-20 rule.ⁱ

i. The basis for the divide-by-20 rule is that the total concentration of a RCRA metal in a non-wastewater form could theoretically fail TCLP based on the assumption that all of the metal is soluble in the TCLP extract. If process knowledge of a particular treatment (extent of immobilization) exists to imply that the TCLP limit would not be exceeded, this would have to be articulated to persuade the reader to accept the assertion of successful treatment (immobilization) regardless of the final reported total concentration.

C3. IN SITU VITRIFICATION DATA SPREADSHEETS

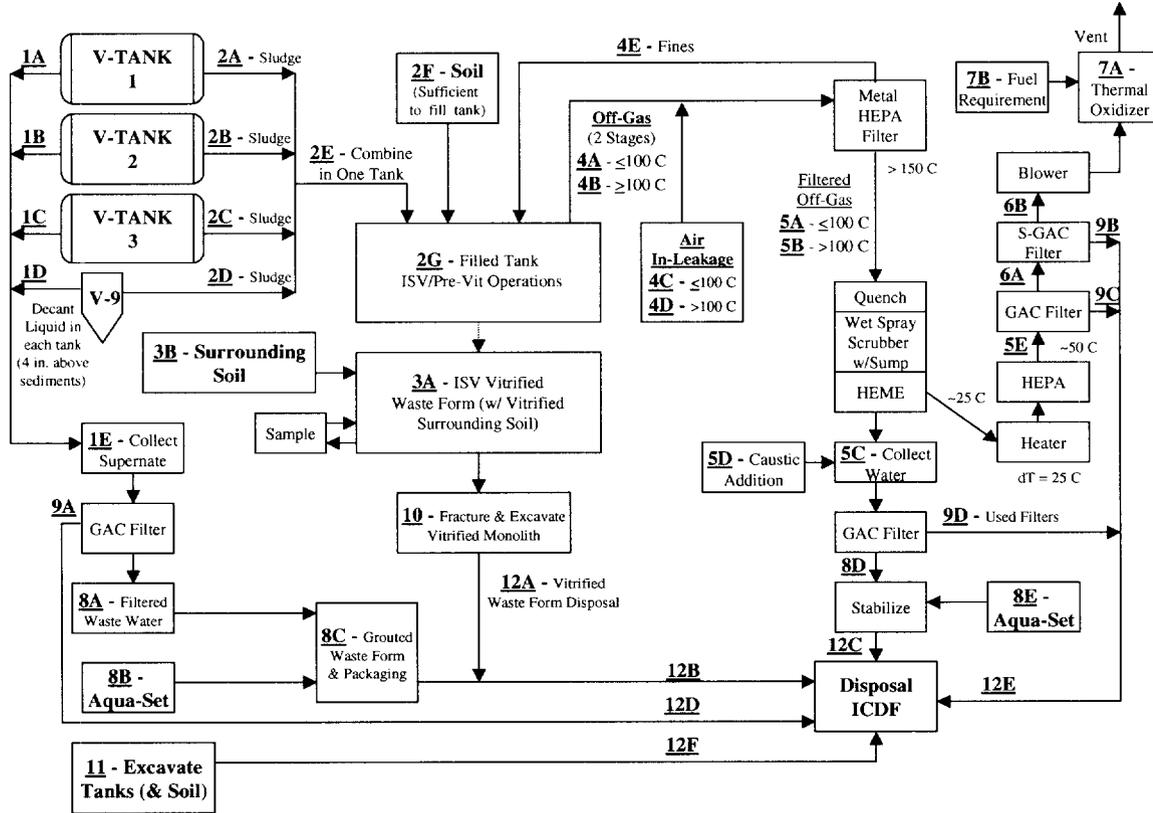


Figure C-1. Alternative 1.a. ISV process flow diagram.

C4. EX SITU DATA SPREADSHEETS

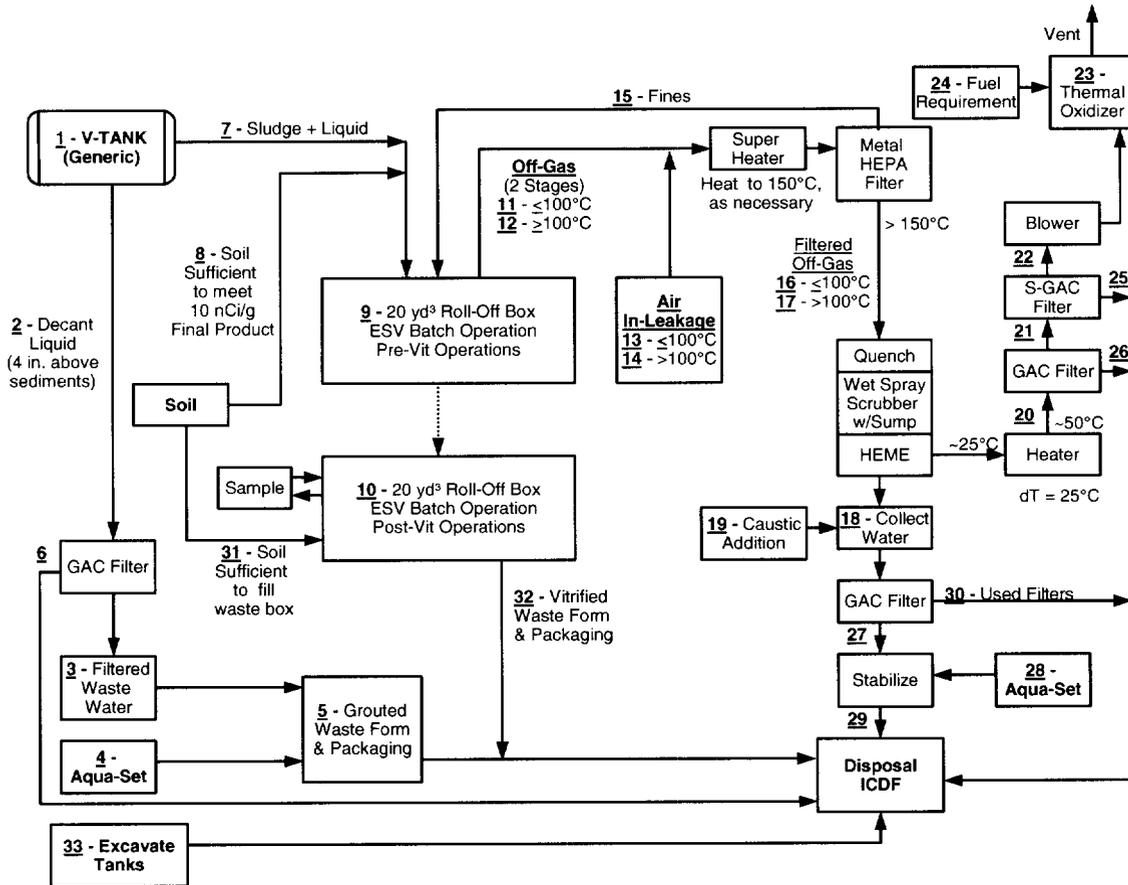


Figure C-2. Alternative 1.b ESV process flow diagram.

C5. TD ON/OFF SITE DATA SPREADSHEETS

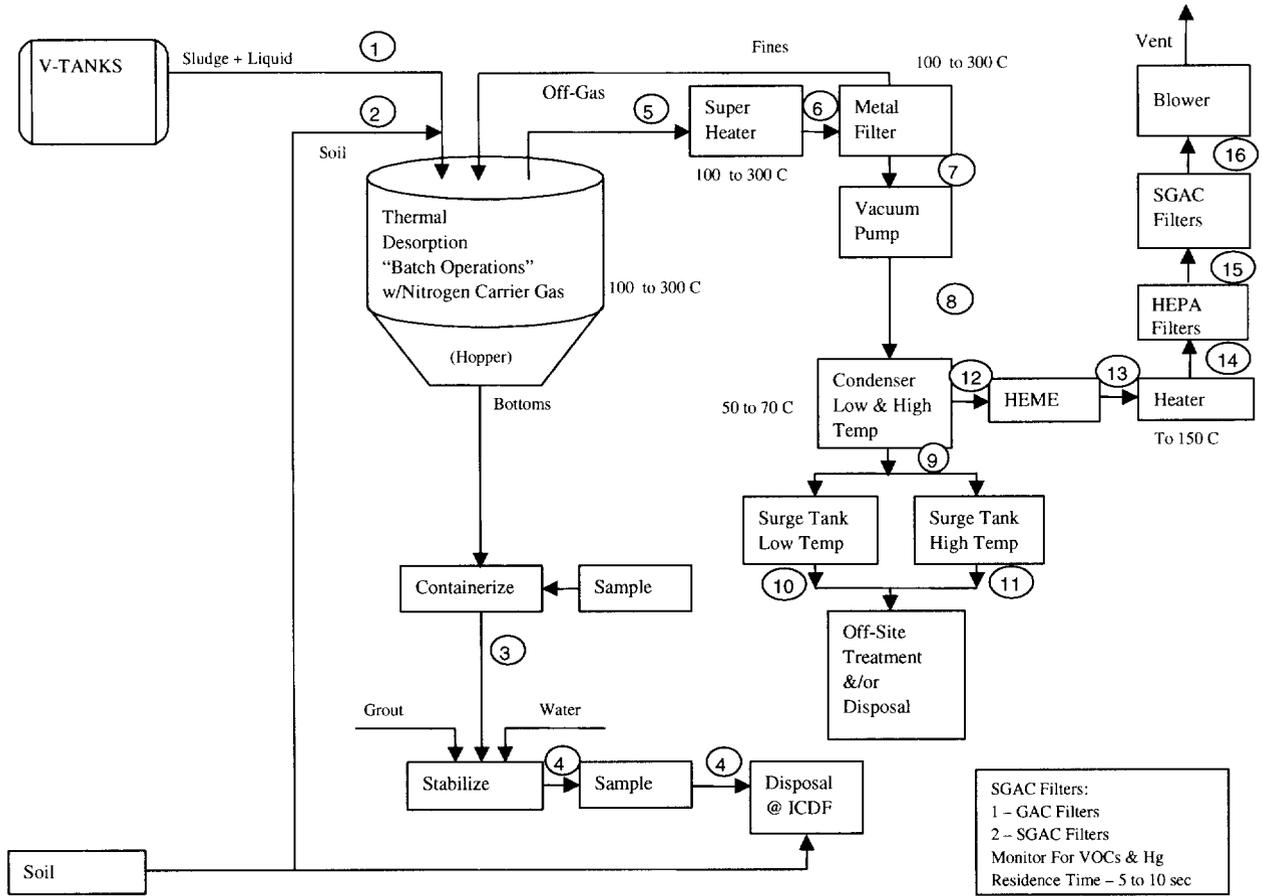


Figure C-3. Alternative 2.a TD – on/off-Site process flow diagram.

C6. TD ON SITE DATA SPREADSHEETS

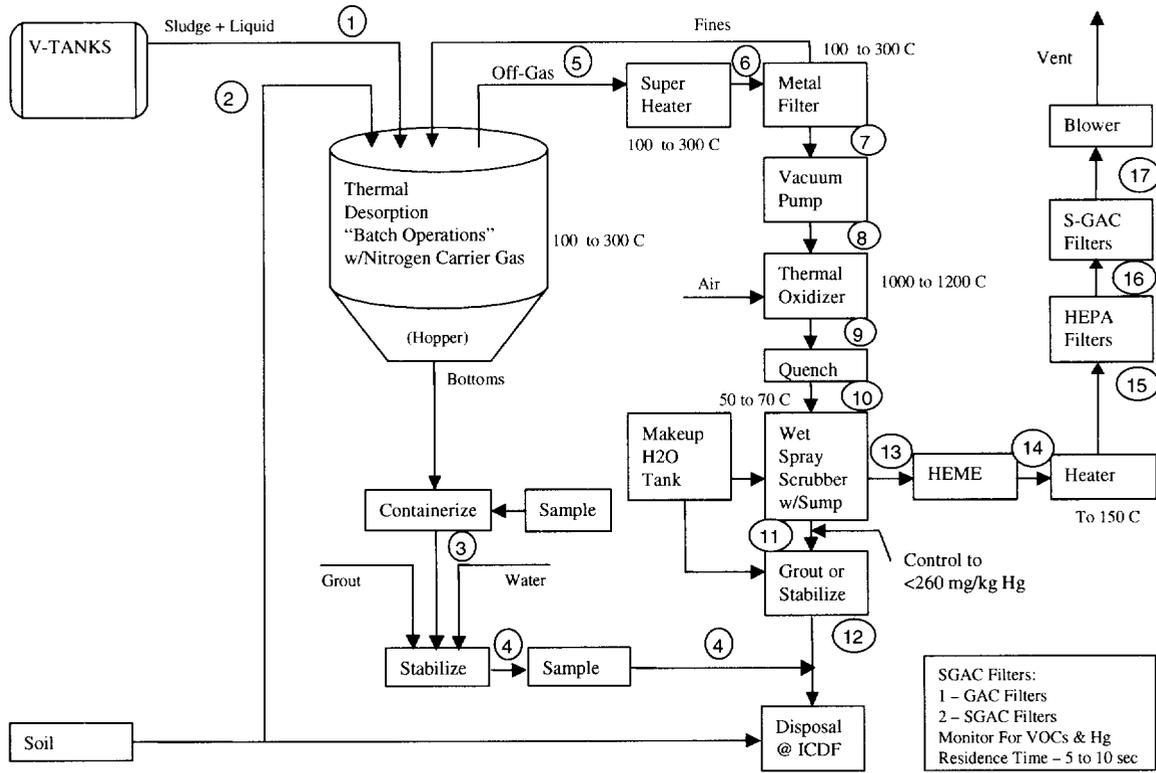


Figure C-4. Alternative 2.b TD – on-site process flow diagram

C7. TD OFF SITE DATA SPREADSHEETS

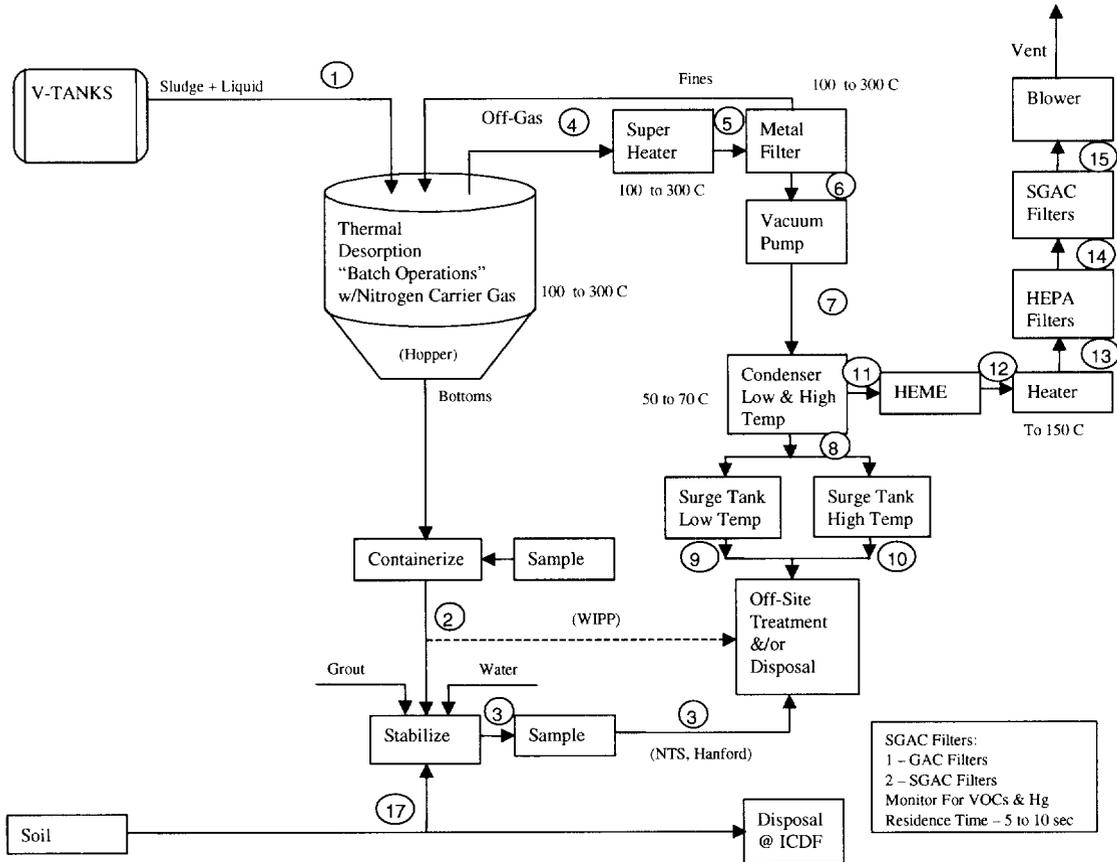


Figure C-5. Alternative 2.c - TD - off-Site process flow diagram.

C8. CO/S IN SITU DATA SPREADSHEETS

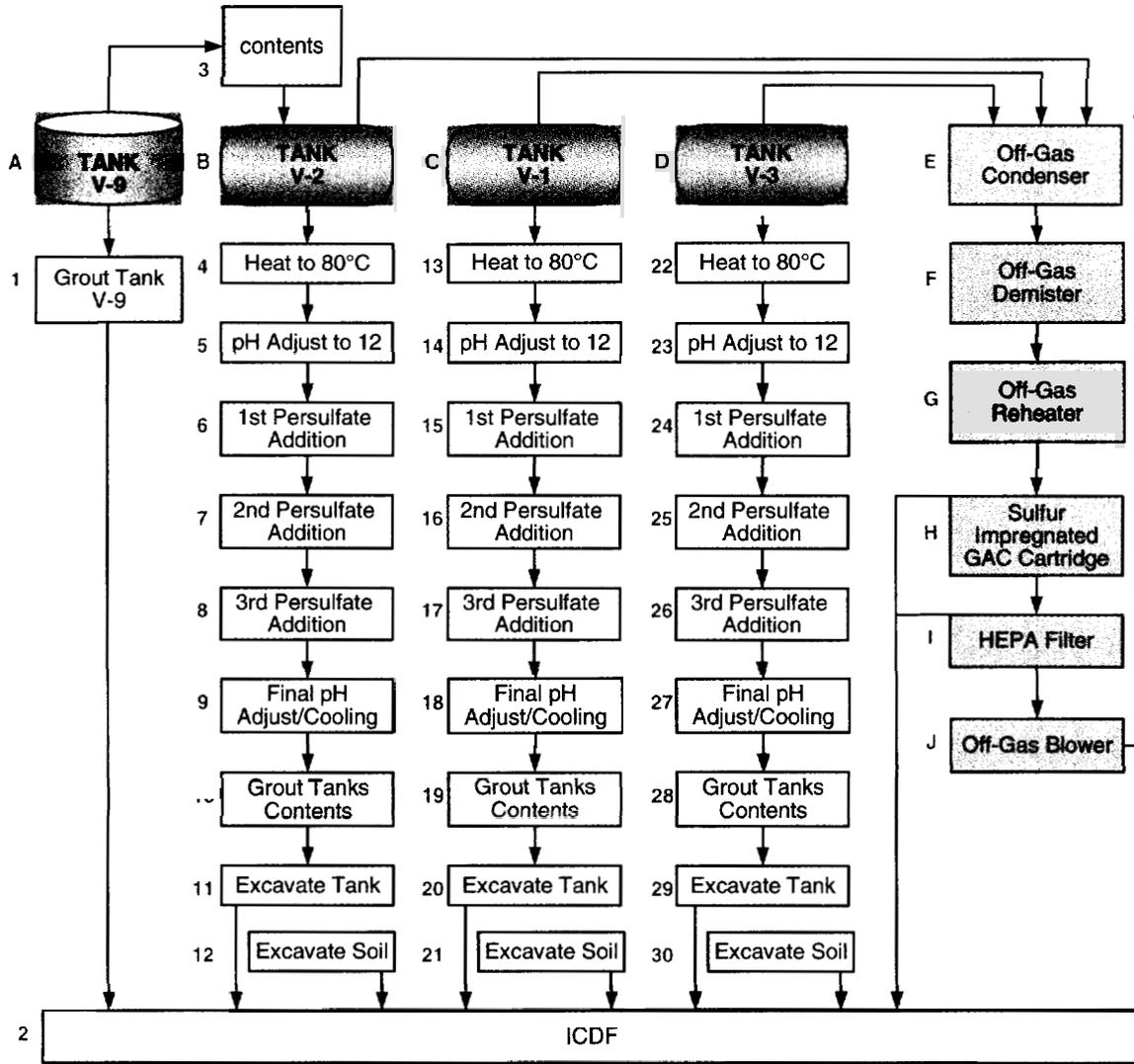


Figure C-6. Alternative 3.a IS-CO/S process flow diagram.

C9. CO/S EX SITU DATA SPREADSHEETS

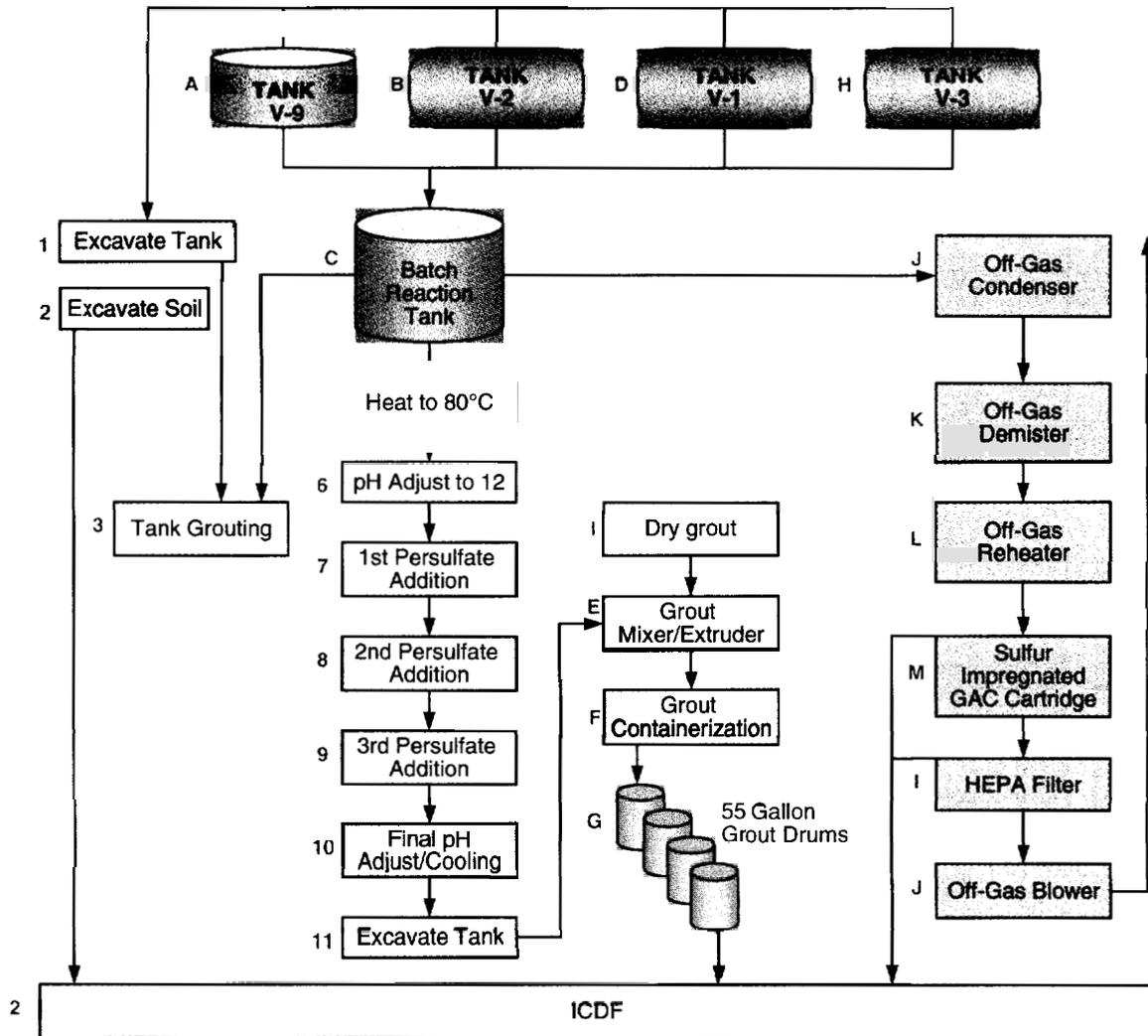
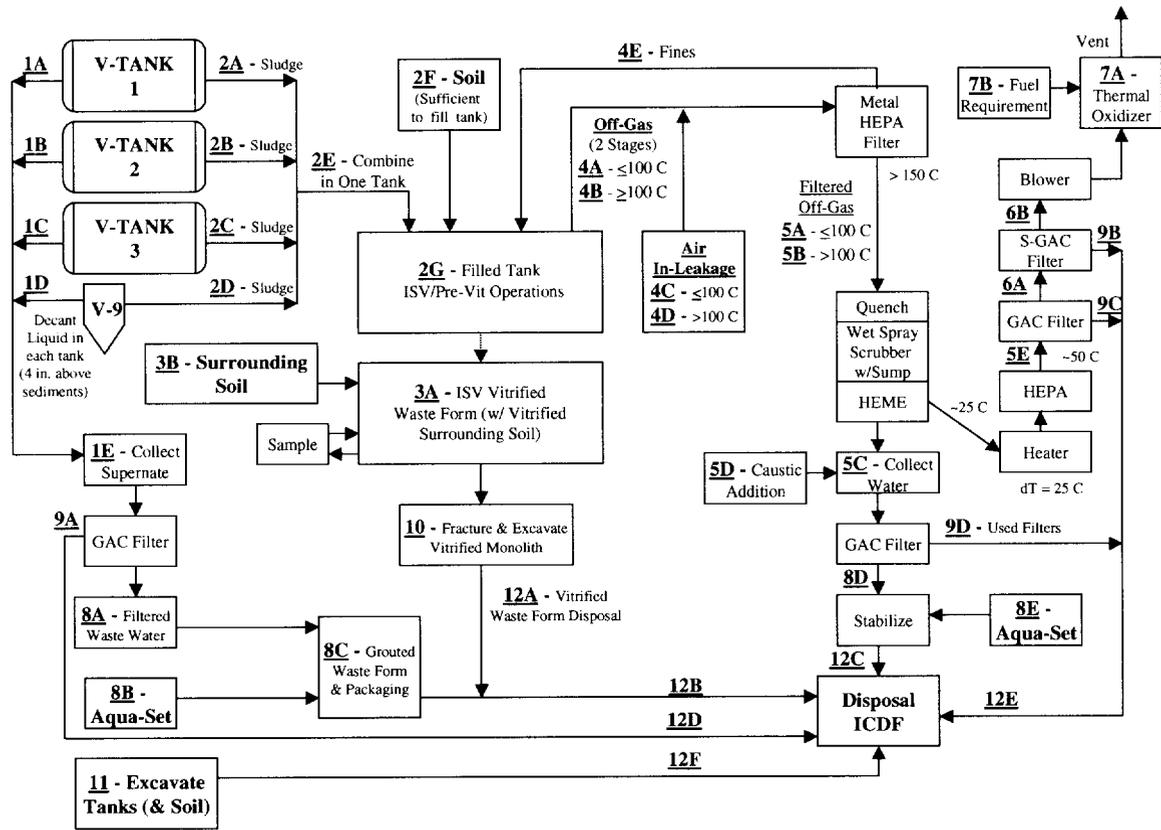
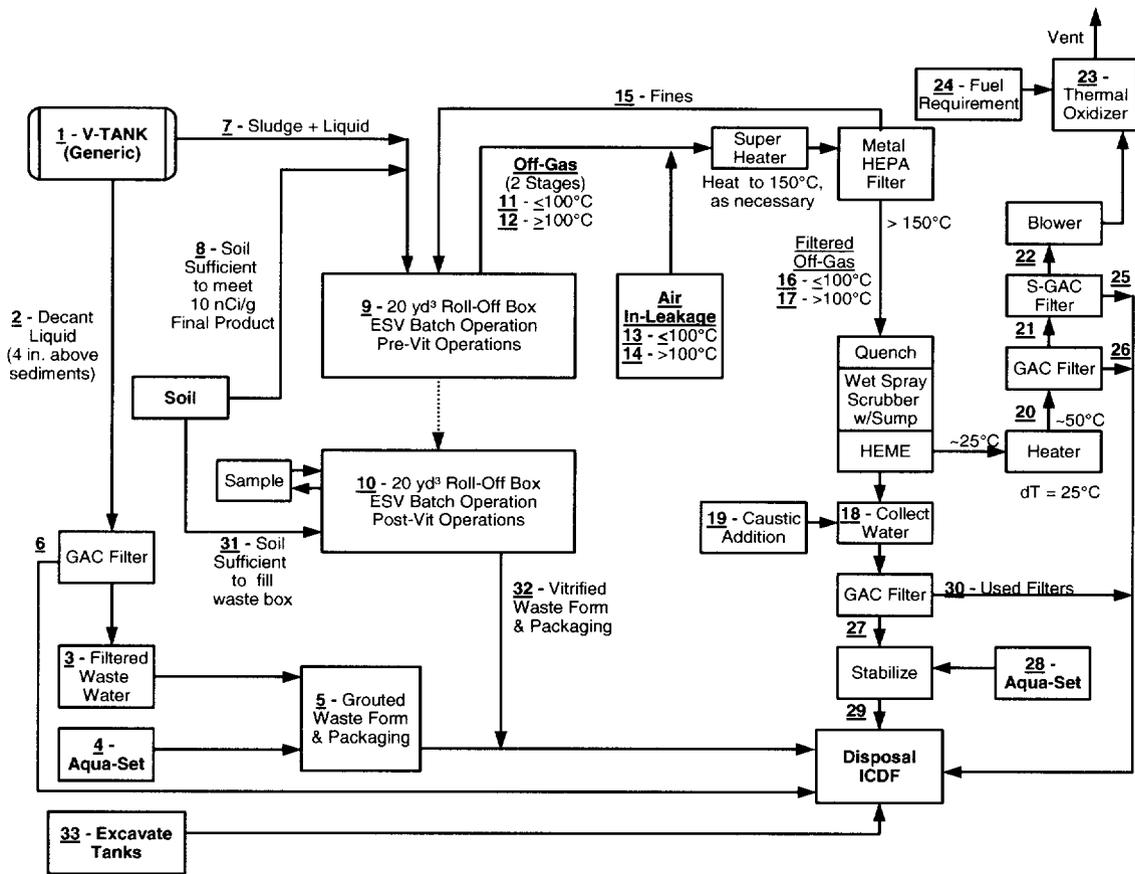


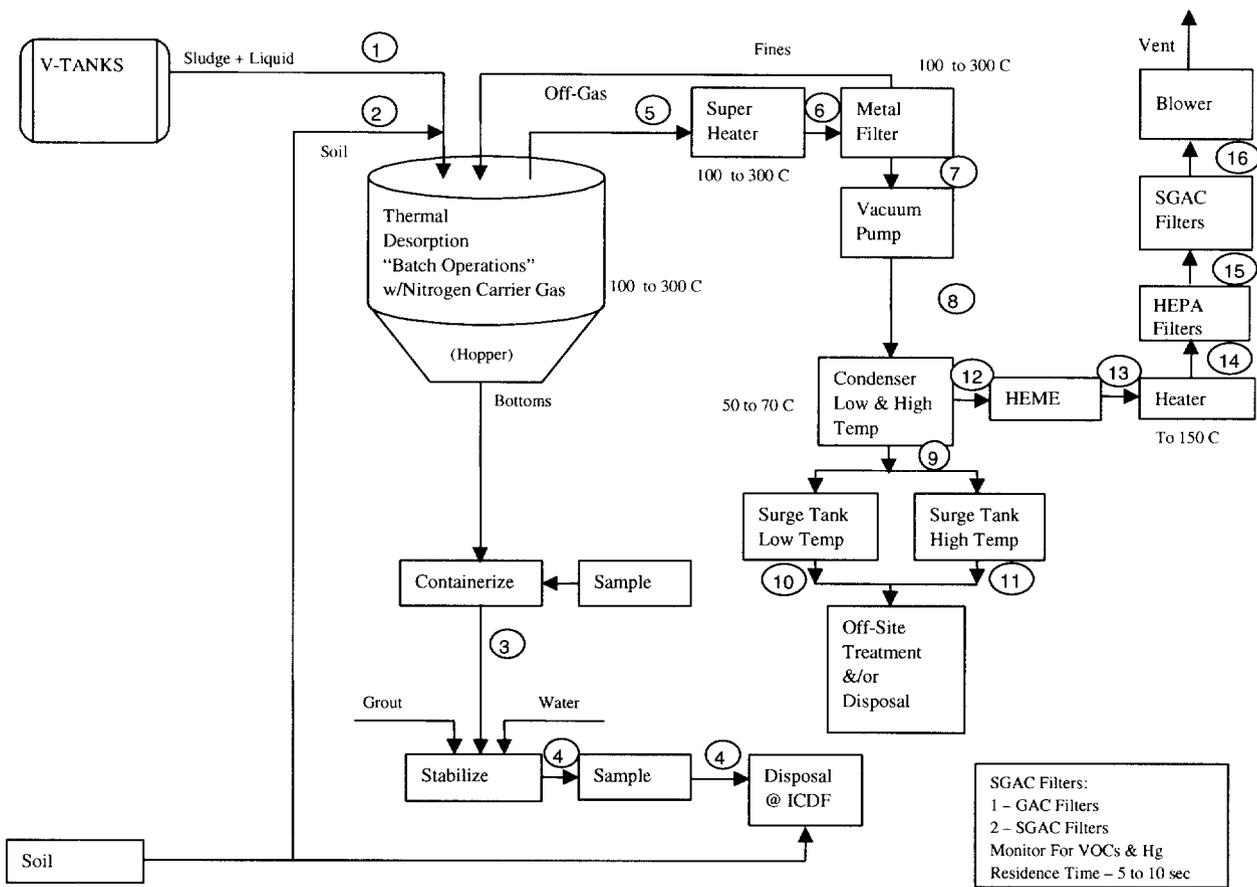
Figure C-7. Alternative 3.b ES-CO/S process flow diagram



In situ VIT



Ex situ VIT



On/Off-Site TD

Option 1 TD Treatment of V-1 Liquid/Sludge (off-site: 1st stage - low temperature application - 1 hour)

Stream Number	1		1+2		3-L		5		6		7		9-L		12		13		14		15&16						
	V-1 mixture	Rotary Kiln Feed Mixture (100 gal/hr)	Rotary Kiln Solids (includes Metal Filter Solids)	Rotary Kiln Off-Gas	Super Heater Off Gas	Metal Filter Off Gas	Condenser Liquid Effluent	Condenser Off Gas	ME Off Gas	Heater Off Gas	HEPA+GAC+S-GAC Off Gas	Temperature, C	Pressure, mmHg	Rate, L/hr	Density, Kg/L	Rate, L/hr	Std fl3/hr	Act fl3/hr	Temperature, C	Pressure, mmHg	Rate, L/hr	Density, Kg/L	Rate, L/hr	Std fl3/hr	Act fl3/hr		
Temperature, C	25	640	25	640	95	620	100	590	60	570	60	570	60	570	60	570	60	570	60	570	60	570	60	570	60	570	
Pressure, mmHg	640	640	640	640	620	620	610	610	610	610	610	570	570	570	570	570	570	570	570	570	570	570	570	570	570	570	
Rate, L/hr	378	3180 (est)	3180 (est)	3180 (est)	1.12E+05	7.40E+04	1.14E+05	1.17E+05	1.14E+05	1.14E+05	1.17E+05	8.84E+02	8.84E+02	8.84E+02	8.84E+02	8.84E+02	8.84E+02	8.84E+02	8.84E+02	8.84E+02	8.84E+02	8.84E+02	8.84E+02	8.84E+02	8.84E+02	8.84E+02	
Density, Kg/Liter	1.006	1.67 (est)	1.67 (est)	1.67 (est)	7.40E+04	7.40E+04	7.40E+04	7.40E+04	7.40E+04	7.40E+04	7.40E+04	1.17E+05	1.17E+05	1.17E+05	1.17E+05	1.17E+05	1.17E+05	1.17E+05	1.17E+05	1.17E+05	1.17E+05	1.17E+05	1.17E+05	1.17E+05	1.17E+05	1.17E+05	
Rate, Kg/hr	380.4	5309.5	5309.5	5309.5	1.82E+03	1.82E+03	1.82E+03	1.82E+03	1.82E+03	1.82E+03	1.82E+03	1.82E+03	1.82E+03	1.82E+03	1.82E+03	1.82E+03	1.82E+03	1.82E+03	1.82E+03	1.82E+03	1.82E+03	1.82E+03	1.82E+03	1.82E+03	1.82E+03	1.82E+03	
Composition	Weight (kg)	100 gal batch V-1 Mixture	Component	Kg/hr	Weight %	Component	Kg/hr	Component	Kg/hr	Component	Kg/hr	Component	Kg/hr	Component	Kg/hr	Component	Kg/hr	Component	Kg/hr	Component	Kg/hr	Component	Kg/hr	Component	Kg/hr	Component	Kg/hr
Al	2.00E-01	Al	2.00E-01	Al2O3	3.78E-01	8.86E-03	H2O	1.06E+03	H2O	1.06E+03	H2O	1.06E+03	H2O	1.06E+03	H2O	1.06E+03	H2O	1.06E+03	H2O	1.06E+03	H2O	1.06E+03	H2O	1.06E+03	H2O	1.06E+03	H2O
Ca	6.76E-01	Ca	6.76E-01	CaO	9.46E-01	2.22E-02	TCE	1.41E-03	TCE	1.41E-03	TCE	1.41E-03	TCE	1.41E-03	TCE	1.41E-03	TCE	1.41E-03	TCE	1.41E-03	TCE	1.41E-03	TCE	1.41E-03	TCE	1.41E-03	TCE
Cr	2.00E-01	Cr	2.00E-01	Cr2O3	2.92E-01	6.86E-03	PCE	1.67E-01	PCE	1.67E-01	PCE	1.67E-01	PCE	1.67E-01	PCE	1.67E-01	PCE	1.67E-01	PCE	1.67E-01	PCE	1.67E-01	PCE	1.67E-01	PCE	1.67E-01	PCE
Fe	1.00E+00	Fe	1.00E+00	Fe2O3	1.43E+00	3.36E-02	N2	7.56E+02	N2	7.56E+02	N2	7.56E+02	N2	7.56E+02	N2	7.56E+02	N2	7.56E+02	N2	7.56E+02	N2	7.56E+02	N2	7.56E+02	N2	7.56E+02	N2
Mg	1.00E+00	Mg	1.00E+00	MgO	1.66E+00	3.89E-02	Hg	2.66E-02	Hg	2.66E-02	Hg	2.66E-02	Hg	2.66E-02	Hg	2.66E-02	Hg	2.66E-02	Hg	2.66E-02	Hg	2.66E-02	Hg	2.66E-02	Hg	2.66E-02	Hg
Mn	2.67E-01	Mn	2.67E-01	MnO	3.45E-01	8.09E-03	SVOC	3.61E-05	SVOC	3.61E-05	SVOC	3.61E-05	SVOC	3.61E-05	SVOC	3.61E-05	SVOC	3.61E-05	SVOC	3.61E-05	SVOC	3.61E-05	SVOC	3.61E-05	SVOC	3.61E-05	SVOC
Si	8.01E+00	Si	8.01E+00	SiO2	1.71E+01	4.02E-01	1,2 di-cl ethylene	1.51E-05	1,2 di-cl ethylene	1.51E-05	1,2 di-cl ethylene	1.51E-05	1,2 di-cl ethylene	1.51E-05	1,2 di-cl ethylene	1.51E-05	1,2 di-cl ethylene	1.51E-05	1,2 di-cl ethylene	1.51E-05	1,2 di-cl ethylene	1.51E-05	1,2 di-cl ethylene	1.51E-05	1,2 di-cl ethylene	1.51E-05	1,2 di-cl ethylene
P	3.66E+00	P	3.66E+00	Nonvolatile-PO4	1.12E+01	2.63E-01																					
Sb	1.95E-03	Sb	1.95E-03	Sb2O3	2.34E-03	5.48E-05																					
Ba	1.64E-02	Ba	1.64E-02	BaO	1.89E-02	4.30E-04																					
Be	3.16E-03	Be	3.16E-03	BeO	8.78E-03	2.06E-04																					
Cd	1.46E-02	Cd	1.46E-02	CdO	1.67E-02	3.91E-04																					
Pb	1.17E-01	Pb	1.17E-01	PbO2	1.35E-01	3.17E-03																					
Hg	1.33E-01	Hg	1.33E-01	Hg	1.06E-01	2.50E-03																					
Ni	3.10E-02	Ni	3.10E-02	NiO	3.94E-02	9.26E-04																					
Ag	1.33E-02	Ag	1.33E-02	Ag2O	1.43E-02	3.35E-04																					
S	2.67E-03	S	2.67E-03	Nonvolatile SO4	6.68E-03	1.57E-04																					
V	6.09E-04	V	6.09E-04	V2O5	1.08E-03	2.54E-05																					
Zn	1.70E+00	Zn	1.70E+00	ZnO	2.12E+00	4.97E-02																					
Cl (total)	1.06E-01	Cl (extra)	0.00E+00	Nonvolatile Cl	0.00E+00	0.00E+00																					
Na	3.84E-01	Na	3.84E-01	Na2O	5.18E-01	1.21E-02																					
K	1.98E-01	K	1.98E-01	K2O	2.39E-01	5.60E-03																					
PCB-1260	1.95E-02	PCB-1260	1.95E-02	PCB-1260	1.95E-02	4.58E-04																					
TCE	1.41E-03	TCE	1.41E-03	TCE	0.00E+00	0.00E+00																					
PCE	1.67E-01	PCE	1.67E-01	PCE	0.00E+00	0.00E+00																					
1,2 di-cl ethylene	1.51E-05	1,2 di-cl ethylene	1.51E-05	1,2 di-cl ethylene	0.00E+00	0.00E+00																					
BEHP	5.29E-01	BEHP	5.29E-01	BEHP	5.29E-01	1.24E-02																					
SVOC	3.61E-04	SVOC	3.61E-04	SVOC	3.25E-04	7.62E-06																					
Carbon (total)	8.78E+00	Carbon (extra)	8.38E+00	Hydraulic Oil	1.01E+01	2.36E-01																					
H2O	3.47E+02	H2O	3.47E+02	H2O	0.00E+00	0.00E+00																					
TRU (Ci)	5.85E-03	TRU (Ci)	5.85E-03	Total Dry Sludge	4.72E+01	1.11E+00																					
Cs 137 (Ci)	1.02E+00	Cs 137 (Ci)	1.02E+00	TRU (Ci)	5.85E-03	5.85E-03																					
Sr 90 (Ci)	5.79E-01	Sr 90 (Ci)	5.79E-01	Cs 137 (Ci)	1.02E+00	1.02E+00																					
				Sr 90 (Ci)	5.79E-01	5.79E-01																					
Stream Number	2	Total Dry Soil	4.21E+03	Dry Soil	4.21E+03	9.89E+01																					
Stream Name	Soil	H2O in Soil	7.15E+02	H2O	0.00E+00	0.00E+00																					
Rate, L/Hr	3286																										
Bulk Density, Kg/Liter	1.5																										
Rate, Kg/Hr	4929.1																										
Composition	Weight %																										
CaAl2Si2O8	19.74%																										
CaCO3	10.54%																										
Fe2O3	3.23%																										
MgCO3.3H2O	7.56%																										
MnCO3	0.10%																										
Ca3(PO4)2	0.41%																										
K2CO3	2.96%																										
SiO2	32.45%																										
NaAlSi3O8	8.09%																										
TiO2	0.40%																										
Total Dry Soil	85.50%																										

Option 1 Mass Balance of TD Treatment on V-2 Liquid/Sludge (off-site: 1st stage - low temperature application- 1 hour)

Stream Number Stream Name	1		1+2		3-L		5		6		7		9-L		12		13		14		15&16			
	V-2 mixture	Rotary Klin Feed Mixture	Rotary Klin Solids (includes Metal Filter Solids)	Rotary Klin Off-Gas	Super Heater Off Gas	Metal Filter Off Gas	Condenser Liquid Effluent	Condenser Off Gas	ME Off Gas	Heater Off Gas	HEPA+GAC+S-GAC Off Gas	Temperature, C	Pressure, mmHg	Act f3/hr	Std f3/hr	Rate, L/hr	Density, g/ml	Temperature, C	Pressure, mmHg	Act f3/hr	Std f3/hr	Rate, L/hr	Density, g/ml	
Temperature, C	25	25	95	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Pressure, mm Hg	640	640	620	610	620	570	570	570	570	570	570	570	570	570	570	570	570	570	570	570	570	570	570	570
Rate, L/hr	378	3076 (est)		1.11E+05	1.11E+05	1.15E+05	8.49E+02	4.70E+04	4.70E+04	4.70E+04	4.70E+04	4.70E+04	4.70E+04	4.70E+04	4.70E+04	4.70E+04	4.70E+04	4.70E+04	4.70E+04	4.70E+04	4.70E+04	4.70E+04	4.70E+04	4.70E+04
Density, Kg/Liter	1.006	1.67 (est)		7.27E+04	7.27E+04	7.27E+04	3.16E+04	3.16E+04	3.16E+04	3.16E+04	3.16E+04	3.16E+04	3.16E+04	3.16E+04	3.16E+04	3.16E+04	3.16E+04	3.16E+04	3.16E+04	3.16E+04	3.16E+04	3.16E+04	3.16E+04	3.16E+04
Rate, Kg/hr	380.2	5136.6	4.13E+03	1.78E+03	1.78E+03	1.78E+03	8.49E+02	9.34E+02	9.34E+02	9.34E+02	9.34E+02	9.34E+02	9.34E+02	9.34E+02	9.34E+02	9.34E+02	9.34E+02	9.34E+02	9.34E+02	9.34E+02	9.34E+02	9.34E+02	9.34E+02	9.34E+02
Composition	100 gal batch	V-2 Mixture	Component	Kg/hr	Weight %	Component	Kg/hr	Component	Kg/hr	Component	Kg/hr	Component	Kg/hr	Component	Kg/hr	Component	Kg/hr	Component	Kg/hr	Component	Kg/hr	Component	Kg/hr	Component
Al	4.24E-01	Al2O3	8.01E-01	1.94E-02	H2O	1.03E+03	H2O	1.03E+03	H2O	1.03E+03	H2O	1.03E+03	H2O	1.03E+03	H2O	1.03E+03	H2O	1.03E+03	H2O	1.03E+03	H2O	1.03E+03	H2O	1.03E+03
Ca	8.50E-01	CaO	1.19E+00	2.88E-02	TCE	8.00E-05	TCE	8.00E-05	TCE	8.00E-05	TCE	8.00E-05	TCE	8.00E-05	TCE	8.00E-05	TCE	8.00E-05	TCE	8.00E-05	TCE	8.00E-05	TCE	8.00E-05
Cr	4.24E-01	Cr2O3	6.20E-01	1.50E-02	PCE	5.24E-02	PCE	5.24E-02	PCE	5.24E-02	PCE	5.24E-02	PCE	5.24E-02	PCE	5.24E-02	PCE	5.24E-02	PCE	5.24E-02	PCE	5.24E-02	PCE	5.24E-02
Fe	2.12E+00	Fe2O3	3.03E+00	7.34E-02	N2	7.56E-02	N2	7.56E-02	N2	7.56E-02	N2	7.56E-02	N2	7.56E-02	N2	7.56E-02	N2	7.56E-02	N2	7.56E-02	N2	7.56E-02	N2	7.56E-02
Mg	8.50E-01	MgO	1.41E+00	3.41E-02	Hg	2.32E-02	Hg	2.32E-02	Hg	2.32E-02	Hg	2.32E-02	Hg	2.32E-02	Hg	2.32E-02	Hg	2.32E-02	Hg	2.32E-02	Hg	2.32E-02	Hg	2.32E-02
Mn	8.50E-01	MnO	1.10E+00	2.68E-02	SVOC	1.54E-04	SVOC	1.54E-04	SVOC	1.54E-04	SVOC	1.54E-04	SVOC	1.54E-04	SVOC	1.54E-04	SVOC	1.54E-04	SVOC	1.54E-04	SVOC	1.54E-04	SVOC	1.54E-04
Si	8.50E+00	SiO2	1.82E+01	4.40E-01	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04
P	5.09E+00	P	5.09E+00	Nonvolatile-PO4	1.96E+01	3.77E-01	1,2 di-cl benzene	8.10E-05	1,2 di-cl benzene	8.10E-05	1,2 di-cl benzene	8.10E-05	1,2 di-cl benzene	8.10E-05	1,2 di-cl benzene	8.10E-05	1,2 di-cl benzene	8.10E-05	1,2 di-cl benzene	8.10E-05	1,2 di-cl benzene	8.10E-05	1,2 di-cl benzene	8.10E-05
Sb	2.00E-03	Sb2O3	2.40E-03	5.80E-05																				
Ba	1.44E-02	BaO	1.61E-02	3.85E-04																				
Be	1.60E-03	BeO	4.44E-03	1.08E-04																				
Cd	1.19E-02	CdO	1.36E-02	3.29E-04																				
Pb	1.15E-01	PbO2	1.33E-01	3.21E-03																				
Hg	1.16E-01	Hg	9.28E-02	2.25E-03																				
Ni	2.89E-02	NiO	3.68E-02	8.90E-04																				
Ag	1.92E-02	Ag2O	2.06E-02	4.99E-04																				
S	1.10E-03	S	1.10E-03	Nonvolatile SO4	3.30E-03	7.99E-05																		
V	0.00E+00	V2O5	0.00E+00	0.00E+00																				
Zn	1.59E-01	ZnO	1.98E-01	4.79E-03																				
Cl (total)	7.75E-02	Cl (extra)	2.56E-02	6.20E-04																				
Na	2.43E-01	Na2O	3.28E-01	7.93E-03																				
K	2.71E-01	K2O	3.26E-01	7.90E-03																				
PCB-1260	1.19E-02	PCB-1260	1.19E-02	2.88E-04																				
TCE	8.00E-05	TCE	8.00E-05	0.00E+00																				
PCE	5.24E-02	PCE	5.24E-02	0.00E+00																				
1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	0.00E+00																				
1,2 di-cl benzene	8.10E-04	1,2 di-cl benzene	8.10E-04	0.00E+00																				
SVOC	1.54E-03	SVOC	1.54E-03	3.36E-05																				
BEHP	4.61E-01	BEHP	4.61E-01	1.12E-02																				
Carbon (total)	1.87E+01	Carbon (extra)	1.83E+01	5.33E-01																				
H2O	3.38E+02	H2O	3.38E+02	0.00E+00																				
TRU (C)	1.94E-03	TRU (C)	1.94E-03	1.59E+00																				
Cs 137 (C)	1.13E+00	Cs 137 (C)	1.13E+00	1.94E-03																				
Sr 90 (C)	1.21E+00	Sr 90 (C)	1.21E+00	1.13E+00																				
Stream Number	2	Soils	Soils	4.07E+03	9.84E+01																			
Stream Name	Total Dry Soil	Total Dry Soil	Total Dry Soil	4.07E+03	9.84E+01																			
Rate, L/hr	Soil	H2O in Soil	H2O in Soil	6.90E+02	0.00E+00																			
Bulk Density, Kg/Liter	3171	Total Dry Product	Total Dry Product	4.13E+03																				
Rate, Kg/hr	4756.4																							
Composition																								
CaAl2Si2O8	Weight %																							
CaCO3	19.74%																							
Fe2O3	10.54%																							
MgCO3.3H2O	3.23%																							
MnCO3	7.58%																							
Ca3(PO4)2	0.10%																							
K2CO3	0.41%																							
SiO2	2.96%																							
NaAlSi3O8	32.45%																							
TiO2	8.09%																							
Total Dry Soil	0.40%																							
Moisture	85.50%																							
	14.50%																							

13	ME Liquid Effluent	
Component		Kg/hr
H2O		10

Hg (ppm)	1.64E+01
TCE (ppm)	1.88E-02
PCE (ppm)	1.23E-01
SVOC (ppm)	1.80E-01
1,2 di-cl ethylene (ppm)	0.00E+00
1,2 di-cl benzene (ppm)	9.44E-02
Rate, L/hr	8.49E+02

Option: 1 Mass Balance of TD Treatment on V-9 Liquid/Sludge (off-site: 1st stage - low temperature application - 1 hour)

Stream Number	1	1+2	3-L	5	6	7	9-L	12	13	14	15&16
Stream Name	V-9 mixture	Rotary Kiln Feed Mixture	Rotary Kiln Solids (Includes Metal Filter Solids)	Rotary Kiln Off-Gas	Super Heater Off Gas	Metal Filter Off Gas	Condenser Liquid Effluent	Condenser Off Gas	ME Off Gas	Heater Off Gas	HEPA+GAC+S-GAC Off Gas
Temperature, C	25	25	95	100	100	100	60	60	60	150	150
Pressure, mm Hg	640	640	620	620	610	590	570	570	550	550	530
Rate, L/Hr	378	2578 (est)		9.91E+04	Act ft3/Hr	1.04E+05	Rate, L/Hr	4.71E+04	Act ft3/Hr	5.99E+04	Act ft3/Hr
Density, Kg/Liter	1.094	1.70 (est)		6.55E+04	Std ft3/hr	6.55E+04	Density, Kg/L	3.16E+04	Std ft3/hr	3.16E+04	Std ft3/hr
Rate, Kg/Hr	414	4383	3.54E+03	1.64E+03	1.64E+03	1.64E+03		9.40E+02	9.30E+02	9.30E+02	9.24E+02
Composition	Weight (kg)										
	100 gal batch	V-9 Mixture	Kg/Hr	Kg/Hr	Component	Kg/Hr	Component	Kg/Hr	Component	Kg/Hr	Component
Al	1.12E+00	Al2O3	2.12E+00	8.80E+02	H2O	8.80E+02	H2O	1.78E+02	H2O	1.68E+02	H2O
Ca	2.80E+00	CaO	3.92E+00	6.03E+00	TCE	6.03E+00	TCE	4.82E+00	TCE	4.82E+00	TCE
Cr	7.84E-01	Cr2O3	1.15E+00	1.76E-01	PCE	1.76E-01	PCE	1.41E-01	PCE	1.41E-01	PCE
Fe	6.06E+00	Fe2O3	8.67E+00	7.56E+02	N2	7.56E+02	N2	0.00E+00	N2	7.56E+02	N2
Mg	3.70E+00	MgO	6.14E+00	1.64E-01	Hg	1.64E-01	Hg	9.86E-02	Hg	6.58E-02	Hg
Mn	1.77E+00	MnO	2.29E+00	1.82E-02	SVOC	1.82E-02	SVOC	1.82E-02	SVOC	1.82E-02	SVOC
Si	2.94E+01	SiO2	6.28E+01	2.30E-02	CH3Cl	2.30E-02	CH3Cl	0.00E+00	CH3Cl	2.30E-02	CH3Cl
P	1.68E+01	Nonvolatile-PO4	5.14E+01	4.30E-02	CH3Br	4.30E-02	CH3Br	0.00E+00	CH3Br	4.30E-02	CH3Br
Sb	4.75E-03	Sb2O3	5.69E-03	1.60E-04	TCA	1.60E-04	TCA	1.48E-01	TCA	5.90E-01	TCA
Ba	1.24E-01	BaO	1.38E-01	3.91E-03	di-cl methane	4.88E-03	di-cl methane	0.00E+00	di-cl methane	4.88E-03	di-cl methane
Be	8.38E-03	BeO	2.33E-02	6.57E-04	di-cl benzene	5.70E-03	di-cl benzene	5.65E-03	di-cl benzene	5.70E-03	di-cl benzene
Cd	1.40E-02	CdO	1.60E-02	4.51E-04							
Pb	1.88E-01	PbO2	2.17E-01	6.12E-03							
Hg	8.22E-01	Hg	6.58E-01	1.86E-02							
Ni	1.32E-01	NiO	1.68E-01	4.74E-03							
Ag	2.16E-01	Ag2O	2.32E-01	6.55E-03							
S	8.00E-06	Nonvolatile-SO4	2.40E-05	6.76E-07							
V	2.02E-03	V2O5	3.61E-03	1.02E-04							
Zn	5.80E-01	ZnO	7.22E-01	2.04E-02							
Cl (total)	3.69E-01	Cl (extra)	0.00E+00	0.00E+00							
Na	8.00E-01	Na2O	1.08E+00	3.04E-02							
K	3.56E+00	K2O	4.29E+00	1.21E-01							
PCB-1260	6.41E-02	PCB-1260	6.41E-02	1.81E-03							
TCE	6.03E+00	TCE	0.00E+00	0.00E+00							
PCE	1.76E-01	PCE	0.00E+00	0.00E+00							
CH3Cl	2.30E-02	CH3Cl	0.00E+00	0.00E+00							
CH3Br	4.30E-02	CH3Br	0.00E+00	0.00E+00							
TCA	7.38E-01	TCA	0.00E+00	0.00E+00							
di-cl methane	4.88E-03	di-cl methane	0.00E+00	0.00E+00							
di-cl benzene	5.70E-02	di-cl benzene	5.13E-02	1.45E-03							
BEHP	2.30E-01	BEHP	2.30E-01	6.49E-03							
SVOC	1.82E-01	SVOC	1.64E-01	6.49E-03							
Carbon (total)	5.31E+00	Carbon (extra)	3.50E+00	Hydraulic Oil							
H2O	3.05E+02	H2O	3.05E+02	0.00E+00							
		Total Dry Sludge	1.51E+02	4.25E+00							
TRU (Cl)	3.05E-02	TRU (Cl)	3.05E-02	TRU (Cl)							
Cs 137 (Cl)	2.83E+00	Cs 137 (Cl)	2.83E+00	Cs 137 (Cl)							
Sr 90 (Cl)	2.15E+00	Sr 90 (Cl)	2.15E+00	Sr 90 (Cl)							
		Soils									
Stream Number	2	Total Dry Soil	3.39E+03	9.57E+01							
Stream Name	Soil	H2O in Soil	0.00E+00								
Rate, L/Hr	2646	Total Dry Product	3.54E+03								
Bulk Density, Kg/Liter	1.5										
Rate, Kg/Hr	3969										
Composition		Weight %									
CaAl2Si2O8		19.74%									
CaCO3		10.54%									
Fe2O3		3.23%									
MgCO3.3H2O		7.58%									
MnCO3		0.10%									
Ca3(PO4)2		0.41%									
K2CO3		2.96%									
SiO2		32.45%									
NaAlSi3O8		8.09%									
TiO2		0.40%									
Total Dry Soil		85.50%									
Moisture		14.50%									

Hg (ppm)	1.40E+02
TCE (ppm)	1.71E+03
PCE (ppm)	5.00E+01
SVOC (ppm)	2.56E+01
CH3Cl (ppm)	0.00E+00
CH3Br (ppm)	0.00E+00
TCA (ppm)	2.10E+02
di-cl methane (ppm)	0.00E+00
di-cl benzene (ppm)	8.02E+00
Rate, L/Hr	7.04E+02

ME Liquid Effluent	Component	Kg/Hr	10
	H2O		

Option:2 TD Treatment of V-1 Sludge/Liquid (on-site: 1st stage - low temperature application-1 hour)

Stream Number	1	1+2	3-1	5	6	7	9	10	11-1	13	14	15	16+17		
Stream Name	V-1 Mixture	Rotary Klin Feed Mixture	Rotary Klin Solids (includes Metal Filter Solids)	Rotary Klin Off-Gas	Super Heater Off Gas	Metal Filter Off Gas	Fuel & Air input to Oxidizer	Thermal Oxidizer Off Gas	Quencher Off Gas	Wet Scrubber Solution	Wet Scrubber Off Gas	ME Off Gas	Heater Off Gas	HEPA+GAC+S-GAC Off Gas	
Temperature, C	25	25	95	Temperature, C	100	100	100	1200	570	60	60	60	150	150	
Pressure, mm Hg	640	640	620	Pressure, mmHg	610	590	570	570	570	560	560	540	540	520	
Rate, L/Hr	378	378	378	Act ft3/hr	1.14E+05	1.17E+05	Act ft3/hr	1.26E+06	Act ft3/hr	3.47E+02	2.74E+05	2.84E+05	3.60E+05	3.74E+05	
Density, Kg/Liter	1.006	1.67 (est)		Std ft3/hr	7.40E+04	7.40E+04	Std ft3/hr	1.91E+05	Std ft3/hr	1.80E+05	1.80E+05	1.80E+05	1.80E+05	1.80E+05	
Rate, Kg/Hr	380.4	5309.5	4.26E+03	Kg/Hr	1.82E+03	1.82E+03	Kg/Hr	5.75E+03	Kg/Hr	3.47E+02	5.50E+03	5.49E+03	5.49E+03	5.49E+03	
Composition	Weight (kg/100 gal batch, V-1 Mixture)	Kg/Hr	Component	Kg/Hr	Component	Kg/Hr	Component	Kg/Hr	Component	Kg/Hr	Component	Kg/Hr	Component	Kg/Hr	Component
Al	2.00E-01	Al2O3	3.78E-01	1.06E+03	H2O	1.06E+03	3.77E+03	3.78E+03	N2	0.00E+00	3.78E+03	3.78E+03	N2	3.78E+03	N2
Ca	6.78E-01	CaO	9.46E-01	1.41E+03	TCE	1.41E+03	1.59E+02	2.40E+02	CO2	2.01E-01	2.40E+02	2.40E+02	CO2	2.40E+02	CO2
Cr	2.00E-01	Cr2O3	2.92E-01	1.67E-01	PCE	1.67E-01	1.99E+03	H2O	1.19E+03	H2O	1.02E+03	1.01E+03	H2O	1.01E+03	H2O
Fe	1.00E+00	Fe2O3	1.43E+00	7.56E+02	N2	7.56E+02	7.56E+02	O2	4.64E+02	O2	4.64E+02	4.64E+02	O2	4.64E+02	O2
Mg	1.00E+00	MgO	1.66E+00	3.89E+02	Hg	2.66E-02	HCl	1.17E-03	HCl	1.17E-03	HCl	0.00E+00	HCl	0.00E+00	HCl
Mn	2.67E-01	MnO	3.45E-01	8.09E-03	SVOC	3.61E-05	SVOC	1.24E-01	Ci2	1.24E-01	Ci2	0.00E+00	Ci2	0.00E+00	Ci2
Si	8.01E+00	SiO2	1.71E+01	4.02E-01	1,2 di-cl ethylene	1.51E-05	1,2 di-cl ethylene	3.67E-02	HgCl2	3.67E-02	HgCl2	7.34E-04	HgCl2	7.34E-04	HgCl2
P	3.66E+00	Nonvolatile-PO4	1.12E+01	2.63E-01											
Sb	1.95E-03	Sb2O3	2.34E-03	5.48E-05											
Ba	1.64E-02	BaO	1.83E-02	4.30E-04											
Be	3.61E-03	BeO	1.00E-02	2.35E-04											
Cd	1.46E-02	CdO	1.67E-02	3.91E-04											
Pb	1.17E-01	PbO2	1.35E-01	3.17E-03											
Hg	1.33E-01	Hg	1.06E-01	2.50E-03											
Ni	3.10E-02	NiO	3.94E-02	9.26E-04											
Ag	1.33E-02	Ag2O	1.43E-02	3.35E-04											
S	2.67E-03	S	8.01E-03	0.00E+00											
V	6.05E-04	V2O5	1.08E-03	2.54E-05											
Zn	1.70E+00	ZnO	2.12E+00	4.97E-02											
Cl (Total)	1.06E-01	Cl (extra)	0.00E+00	0.00E+00											
Na	3.84E-01	Na2O	5.18E-01	1.21E-02											
K	1.98E-01	K2O	2.39E-01	5.60E-03											
PCB-1260	1.95E-02	PCB-1260	1.95E-02	4.58E-04											
TCE	1.41E-03	TCE	1.41E-03	0.00E+00											
PCE	1.67E-01	PCE	0.00E+00	0.00E+00											
1,2 di-cl ethylene	1.51E-05	1,2 di-cl ethylene	0.00E+00	0.00E+00											
BEHP	5.29E-01	BEHP	5.29E-01	1.24E-02											
SVOC	3.61E-04	SVOC	3.25E-04	7.62E-06											
Carbon (total)	8.78E+00	Carbon (extra)	8.38E+00	Hydraulic Oil											
H2O	3.47E+02	H2O	3.47E+02	0.00E+00											
TRU (Ci)	5.85E-03	TRU (Ci)	4.72E+01	1.11E+00											
Cs 137 (Ci)	1.02E+00	Cs 137 (Ci)	5.85E-03	5.85E-03											
Sr 90 (Ci)	5.79E-01	Sr 90 (Ci)	1.02E+00	1.02E+00											
Soils															
Stream Number	2	Total Dry Soil	Dry Soil	4.21E+03	9.89E+01										
Stream Name	Soil	H2O in Soil	H2O in Soil	7.15E+02	0.00E+00										
Rate, L/Hr															
Bulk Density, Kg/Liter		3286													
Rate, Kg/Hr		4929.1													
Composition			Weight %												
CaAl2Si2O8			19.74%												
CaCO3			10.54%												
Fe2O3			3.23%												
MgCO3.3H2O			7.58%												
MnCO3			0.10%												
Ca3(PO4)2			0.41%												
K2CO3			2.96%												
SiO2			32.45%												
NaAlSi3O8			8.09%												
TrO2			0.40%												
Total Dry Soil			85.50%												
Moisture			14.50%												

14	ME Liquid Effluent
Component	Kg/hr
H2O	10

10	Quencher & Scrubber Feed Liquid
Component	Kg/hr
H2O	1.78E+02

Option-2 Mass Balance of TD Treatment on V-2 Sludge (on-site, 1st stage - low temperature application - 1 hour)

Stream Number	1		1+2		3-3		5		6		7		9		10		11-1		13		14		15		16&17												
	V-2 Mixture	Rotary KIn Feed Mixture	Rotary KIn (includes Metal Filter Solids)	Rotary KIn Off-Gas	Super Heater Off Gas	Metal Filter Off Gas	Fuel & Air input to Oxidizer	Thermal Oxidizer Off Gas	Quencher Off Gas	Wet Scrubber Solution	Wet Scrubber Off Gas	ME Off Gas	Heater Off Gas	HEPA+GAC+S-GAC Off Gas	Temperature, C	Pressure, mm Hg	Rate, L/Hr	Density, Kg/Liter	Rate, Kg/Hr	Temperature, C	Pressure, mm Hg	Rate, L/Hr	Density, Kg/Liter	Rate, Kg/Hr	Temperature, C	Pressure, mm Hg	Rate, L/Hr	Density, Kg/Liter	Rate, Kg/Hr								
Temperature, C	25	640	25	640	95	620	95	620	100	570	100	570	1200	570	100	570	60	540	60	540	150	540	150	540	150	540	150	540	150	540							
Pressure, mm Hg	640	640	640	640	620	620	620	620	610	590	590	590	570	570	570	570	560	540	560	560	560	560	560	560	560	560	560	560	560	560							
Rate, L/Hr	378	3063 (est)	3063 (est)	3063 (est)	1.10E+05	1.10E+05	1.10E+05	1.10E+05	1.11E+05	1.15E+05	1.15E+05	1.15E+05	1.26E+05	1.26E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05							
Density, Kg/Liter	1.006	1.67 (est)	1.67 (est)	1.67 (est)	1.10E+05	1.10E+05	1.10E+05	1.10E+05	1.11E+05	1.15E+05	1.15E+05	1.15E+05	1.26E+05	1.26E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05							
Rate, Kg/Hr	380.2	5136.6	5136.6	5136.6	1.10E+05	1.10E+05	1.10E+05	1.10E+05	1.11E+05	1.15E+05	1.15E+05	1.15E+05	1.26E+05	1.26E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05	3.19E+05							
Composition	Weight (kg)	100 gal batch	V-2 Mixture	Rotary KIn (includes Metal Filter Solids)	Rotary KIn Off-Gas	Super Heater Off Gas	Metal Filter Off Gas	Fuel & Air input to Oxidizer	Thermal Oxidizer Off Gas	Quencher Off Gas	Wet Scrubber Solution	Wet Scrubber Off Gas	ME Off Gas	Heater Off Gas	HEPA+GAC+S-GAC Off Gas	Temperature, C	Pressure, mm Hg	Rate, L/Hr	Density, Kg/Liter	Rate, Kg/Hr	Temperature, C	Pressure, mm Hg	Rate, L/Hr	Density, Kg/Liter	Rate, Kg/Hr	Temperature, C	Pressure, mm Hg	Rate, L/Hr	Density, Kg/Liter	Rate, Kg/Hr							
Al	4.24E-01	Al2O3	8.01E-01	1.94E-02	H2O	1.03E+03	H2O	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03	1.03E+03					
Ca	8.50E-01	CaO	1.19E+00	2.88E-02	TCE	8.00E-05	TCE	8.00E-05	8.00E-05	8.00E-05	8.00E-05	8.00E-05	8.00E-05	8.00E-05	8.00E-05	8.00E-05	8.00E-05	8.00E-05	8.00E-05	8.00E-05	8.00E-05	8.00E-05	8.00E-05	8.00E-05	8.00E-05	8.00E-05	8.00E-05	8.00E-05	8.00E-05	8.00E-05	8.00E-05	8.00E-05	8.00E-05				
Cr	4.24E-01	Cr	6.20E-01	1.50E-02	PCE	5.24E-02	PCE	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02				
Fe	2.12E+00	Fe2O3	3.03E+00	7.34E-02	N2	7.56E+02	N2	7.56E+02	7.56E+02	7.56E+02	7.56E+02	7.56E+02	7.56E+02	7.56E+02	7.56E+02	7.56E+02	7.56E+02	7.56E+02	7.56E+02	7.56E+02	7.56E+02	7.56E+02	7.56E+02	7.56E+02	7.56E+02	7.56E+02	7.56E+02	7.56E+02	7.56E+02	7.56E+02	7.56E+02	7.56E+02	7.56E+02				
Mg	8.50E-01	MgO	1.41E+00	3.41E-02	Hg	2.32E-02	Hg	2.32E-02	2.32E-02	2.32E-02	2.32E-02	2.32E-02	2.32E-02	2.32E-02	2.32E-02	2.32E-02	2.32E-02	2.32E-02	2.32E-02	2.32E-02	2.32E-02	2.32E-02	2.32E-02	2.32E-02	2.32E-02	2.32E-02	2.32E-02	2.32E-02	2.32E-02	2.32E-02	2.32E-02	2.32E-02	2.32E-02				
Mn	8.50E-01	MnO	1.10E+00	2.66E-02	SVOC	1.54E-04	SVOC	1.54E-04	1.54E-04	1.54E-04	1.54E-04	1.54E-04	1.54E-04	1.54E-04	1.54E-04	1.54E-04	1.54E-04	1.54E-04	1.54E-04	1.54E-04	1.54E-04	1.54E-04	1.54E-04	1.54E-04	1.54E-04	1.54E-04	1.54E-04	1.54E-04	1.54E-04	1.54E-04	1.54E-04	1.54E-04	1.54E-04				
Si	8.50E+00	SiO2	8.50E+00	1.82E+01	4.40E-01	1.2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04				
P	5.09E+00	P	5.09E+00	1.10E-04	1,2 di-cl benzene	8.10E-05	1,2 di-cl benzene	8.10E-05	8.10E-05	8.10E-05	8.10E-05	8.10E-05	8.10E-05	8.10E-05	8.10E-05	8.10E-05	8.10E-05	8.10E-05	8.10E-05	8.10E-05	8.10E-05	8.10E-05	8.10E-05	8.10E-05	8.10E-05	8.10E-05	8.10E-05	8.10E-05	8.10E-05	8.10E-05	8.10E-05	8.10E-05	8.10E-05				
Sb	2.00E-03	Sb2O3	2.00E-03	5.80E-05																																	
Ba	1.44E-02	BaO	1.44E-02	3.89E-04																																	
Be	1.60E-03	BeO	1.60E-03	1.08E-04																																	
Cd	1.19E-02	CdO	1.19E-02	3.29E-04																																	
Pb	1.15E-01	PbO2	1.15E-01	3.21E-03																																	
Hg	1.19E-01	Hg	1.19E-01	3.21E-03																																	
Ni	2.89E-02	NiO	2.89E-02	8.90E-04																																	
Ag	1.92E-02	Ag2O	1.92E-02	4.99E-04																																	
S	1.10E-03	S	1.10E-03	7.99E-05																																	
V	0.00E+00	V2O5	0.00E+00	0.00E+00																																	
Zn	1.59E-01	ZnO	1.59E-01	4.79E-03																																	
Cl (total)	7.75E-02	Cl (extra)	2.56E-02	Nonvolatile Cl	2.56E-02	6.20E-04																															
Na	2.43E-01	Na2O	2.43E-01	7.93E-03																																	
K	2.71E-01	K2O	2.71E-01	7.90E-03																																	
PCB-1260	1.19E-02	PCB-1260	1.19E-02	2.88E-04																																	
TCE	8.00E-05	TCE	8.00E-05	0.00E+00																																	
PCE	5.24E-02	PCE	5.24E-02	0.00E+00																																	
1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	0.00E+00																																	
1,2 di-cl benzene	8.10E-04	1,2 di-cl benzene	8.10E-04	1.76E-05																																	
SVOC	1.54E-03	SVOC	1.54E-03	3.35E-05																																	
BEHP	4.61E-01	BEHP	4.61E-01	1.12E-02																																	
Carbon (total)	1.87E+01	Carbon (extra)	1.87E+01	5.33E-01																																	
H2O	3.38E+02	H2O	3.38E+02	0.00E+00																																	
TRU (Ci)	1.94E-03	TRU (Ci)	1.94E-03	6.58E-01																																	
Cs 137 (Ci)	1.13E+00	Cs 137 (Ci)	1.13E+00	1.94E-03																																	
Sr 90 (Ci)	1.21E+00	Sr 90 (Ci)	1.21E+00	1.21E+00																																	
Stream Number	2	Total Dry Soil	4.07E+03	Dry Soil	9.84E+01																																

Mass Balance of TD Treatment on V-2 Sludge (on site, 2nd stage - High Temperature application - 2 hours)

3-L		3-H		5		6		7		8		9		10		11		13		14		15		16-17					
Rotary Kiln Solids (Initial) (100 gal batch, 50 gal/hr rate)	Rotary Kiln Solids (product) (includes metal filter Solids)	Rotary Kiln Off-Gas Temperature, C Pressure, mm Hg	Super Heater Off Gas	Metal Filter Off Gas	Vacuum Pump Off Gas	Fuel & Air input to Oxidizer	Thermal Oxidizer Off Gas Temperature, C Pressure, mm Hg	Quencher Off Gas	Wet Scrubber Solution	Wet Scrubber Off Gas	ME Off Gas	Heater Off-Gas	HEPA+GAC+S-GAC Off Gas	Component	Weight %	Kg/Hr	Component	Weight %	Kg/Hr	Component	Weight %	Kg/Hr	Component	Weight %	Kg/Hr	Component	Weight %	Kg/Hr	
Al2O3	4.00E-01	1.94E-02	Al2O3	4.00E-01	1.95E-02	N2	6.27E+01	N2	6.27E+01	N2	6.27E+01	N2	2.62E+02	N2	2.62E+02	N2	2.62E+02	N2	2.62E+02	N2	2.62E+02	N2	2.62E+02	N2	2.62E+02	N2	2.62E+02	N2	
CaO	5.95E-01	2.88E-02	CaO	5.95E-01	2.89E-02	Hg	4.64E-02	Hg	4.64E-02	Hg	4.64E-02	Hg	3.48E-01	CO2	3.48E-01	CO2	3.48E-01	CO2	3.48E-01	CO2	3.48E-01	CO2	3.48E-01	CO2	3.48E-01	CO2	3.48E-01	CO2	
Cr2O3	3.10E-01	1.50E-02	Cr2O3	3.10E-01	1.51E-02	PCB-1260	5.94E-03	PCB-1260	5.94E-03	PCB-1260	5.94E-03	PCB-1260	1.54E-01	H2O	1.54E-01	H2O	1.54E-01	H2O	1.54E-01	H2O	1.54E-01	H2O	1.54E-01	H2O	1.54E-01	H2O	1.54E-01	H2O	
Fe2O3	1.52E+00	7.34E-02	Fe2O3	1.52E+00	7.38E-02	BEHP	2.30E-01	BEHP	2.30E-01	BEHP	2.30E-01	BEHP	2.30E-01	BEHP	2.30E-01	BEHP	2.30E-01	BEHP	2.30E-01	BEHP	2.30E-01	BEHP	2.30E-01	BEHP	2.30E-01	BEHP	2.30E-01	BEHP	
MgO	7.05E-01	3.41E-02	MgO	7.05E-01	3.49E-02	Hydraulic Oil	1.10E+01	Hydraulic Oil	1.10E+01	Hydraulic Oil	1.10E+01	Hydraulic Oil	3.51E-02	Hg	3.51E-02	Hg	3.51E-02	Hg	3.51E-02	Hg	3.51E-02	Hg	3.51E-02	Hg	3.51E-02	Hg	3.51E-02	Hg	
MnO	5.49E-01	2.66E-02	MnO	5.49E-01	2.67E-02	1,2 di-cl benzene	3.65E-04	1,2 di-cl benzene	3.65E-04	1,2 di-cl benzene	3.65E-04	1,2 di-cl benzene	1.47E-02	HgCl2	1.47E-02	HgCl2	1.47E-02	HgCl2	1.47E-02	HgCl2	1.47E-02	HgCl2	1.47E-02	HgCl2	1.47E-02	HgCl2	1.47E-02	HgCl2	
SiO2	9.09E+00	4.40E-01	SiO2	9.09E+00	4.42E-01	SVOC	6.93E-04	SVOC	6.93E-04	SVOC	6.93E-04	SVOC	6.93E-04	SVOC	6.93E-04	SVOC	6.93E-04	SVOC	6.93E-04	SVOC	6.93E-04	SVOC	6.93E-04	SVOC	6.93E-04	SVOC	6.93E-04	SVOC	
Nonvolatile-PO4	7.80E+00	3.77E-01	Nonvolatile-PO4	7.80E+00	3.80E-01																								
Sr2O3	1.20E-03	5.80E-05	Sr2O3	1.20E-03	5.83E-05																								
BaO	8.04E-03	3.89E-04	BaO	8.04E-03	3.91E-04																								
BeO	2.22E-03	1.07E-04	BeO	2.22E-03	1.08E-04																								
CdO	6.80E-03	3.29E-04	CdO	6.80E-03	3.31E-04																								
PbO2	6.64E-02	3.21E-03	PbO2	6.64E-02	3.23E-03																								
Hg	4.64E-02	2.25E-03	Hg	4.64E-02	2.26E-03																								
NO	1.84E-02	8.91E-04	NO	1.84E-02	8.95E-04																								
Ag2O	1.03E-02	4.99E-04	Ag2O	1.03E-02	5.01E-04																								
Nonvolatile SO4	1.65E-03	7.99E-05	NonvolatileSO4	1.65E-03	8.03E-05																								
V2O5	0.00E+00	0.00E+00	V2O5	0.00E+00	0.00E+00																								
ZnO	9.89E-02	4.79E-03	ZnO	9.89E-02	4.82E-03																								
Nonvolatile Cl	1.28E-02	6.20E-04	Nonvolatile Cl	1.28E-02	6.23E-04																								
Na2O	1.64E-01	7.93E-03	Na2O	1.64E-01	7.97E-03																								
K2O	1.63E-01	7.90E-03	K2O	1.63E-01	7.94E-03																								
PCB-1260	5.95E-03	2.88E-04	PCB-1260	5.95E-03	2.90E-04																								
SVOC	6.93E-04	3.35E-05	SVOC	6.93E-04	3.35E-05																								
BEHP	2.31E-01	1.12E-02	BEHP	2.31E-01	1.12E-02																								
1,2 di-cl benzene	3.65E-04	1.77E-05	1,2 di-cl benzene	3.65E-04	1.77E-05																								
Hydraulic Oil	1.10E+01	5.33E-01	Hydraulic Oil	1.10E+01	5.33E-01																								
Dry Soil	2.03E+03	9.84E+01	Dry Soil	2.03E+03	9.90E+01																								
Total	2.07E+03		Total	2.05E+03																									
TRU (Ci)	9.70E-04		TRU (mCi/g)	4.72E-01																									
Cs 137 (Ci)	5.65E-01		Cs 137 (mCi/g)	2.75E+02																									
Sr 90 (Ci)	6.05E-01		Sr 90 (mCi/g)	2.94E+02																									

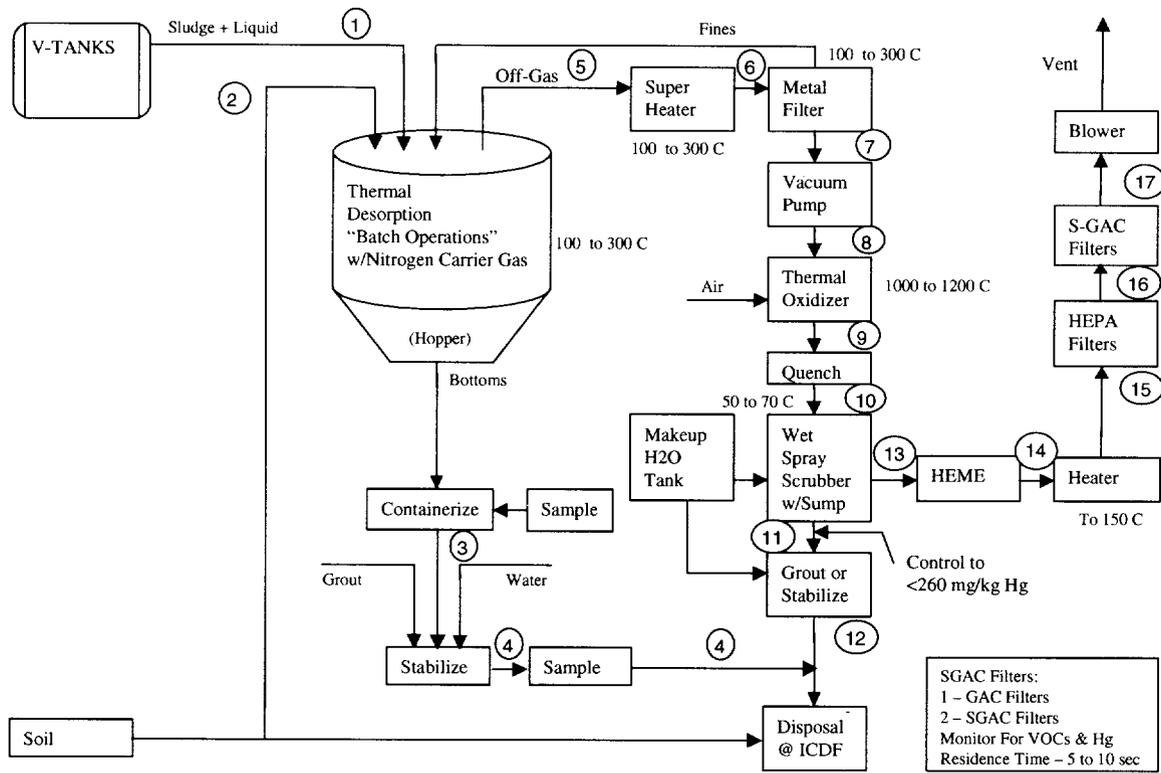
10	
Quencher & Scrubber	
Feed Liquid	
Component	Kg/hr
H2O	6.28E+01

Option 2 Mass Balance of TD Treatment on V.9 Sludge (on-site - 1st stage - low temperature application - 1 hour)

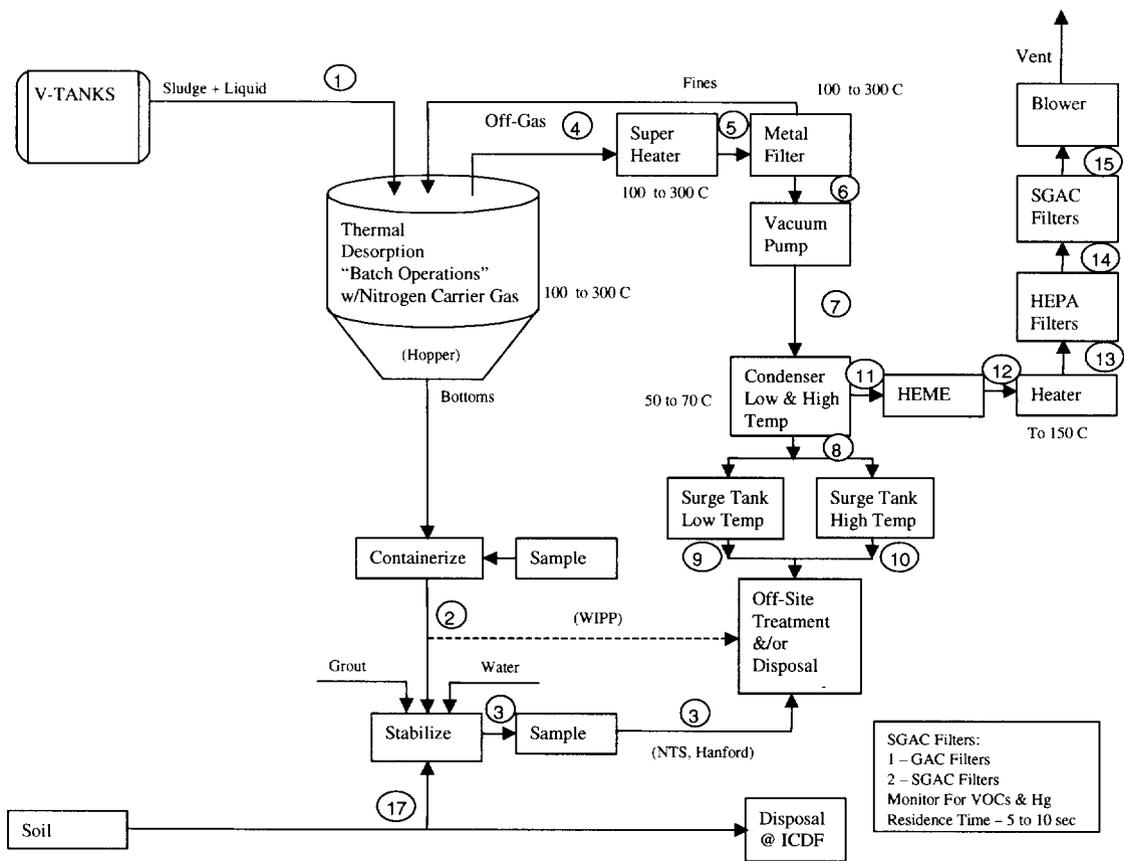
Stream Number	1		1+2		3-1		5		6		7		9		10		11-L		13		14		15	
	V-9 Mixture	Rotary Kilm Feed Mixture	Rotary Kilm (includes Metal Filler Solids)	Rotary Kilm Solids	Rotary Kiln Off-Gas	Super Heater Off Gas	Metal Filter Off Gas	Fuel & Air Inlet to Oxidizer	Thermal Oxidizer Off Gas	Quencher Off Gas	Wet Scrubber Solution	Wet Scrubber Off Gas	ME Off Gas	Heater Off Gas	HEPA-GAC-S-GAC Off Gas									
Temperature, C	378	2578 (esti)	95	620	100	610	100	1200	570	100	570	60	540	150										
Pressure, mm Hg	1.094	1.70 (esti)	640	620	95	620	620	620	620	620	620	620	620	620										
Rate, L/HR	378	2578 (esti)	640	620	100	610	100	1200	570	100	570	60	540	150										
Density, Kg/Liter	1.094	1.70 (esti)	640	620	95	620	620	620	620	620	620	620	620	620										
Rate, Kg/HR	414	4383	3.54E+03	3.54E+03	1.64E+03	1.64E+03	1.64E+03	1.64E+03	1.64E+03	1.64E+03	1.64E+03	1.64E+03	1.64E+03	1.64E+03										
Composition	Weight (kg)	Weight (kg)	Component	Component	Kg/HR	Kg/HR	Component	Component	Component	Component	Component	Component	Component	Component										
Al	100 gal batch	1.12E+00	Al2O3	Al2O3	1.12E+00	5.97E-02	H2O	H2O	8.80E-02	H2O	8.80E-02	8.80E-02	8.80E-02	8.80E-02										
Ca	2.80E+00	2.80E+00	CaO	CaO	2.80E+00	1.11E-01	TCE	TCE	6.03E-00	TCE	6.03E-00	6.03E-00	6.03E-00	6.03E-00										
Cr	7.84E-01	7.84E-01	Cr2O3	Cr2O3	7.84E-01	3.23E-02	PCE	PCE	1.78E-01	PCE	1.78E-01	1.78E-01	1.78E-01	1.78E-01										
Fe	6.06E+00	6.06E+00	Fe2O3	Fe2O3	6.06E+00	2.45E-01	N2	N2	7.56E-02	N2	7.56E-02	7.56E-02	7.56E-02	7.56E-02										
Mg	3.70E+00	3.70E+00	MgO	MgO	3.70E+00	1.73E-01	Hg	Hg	1.64E-01	Hg	1.64E-01	1.64E-01	1.64E-01	1.64E-01										
Mn	1.77E+00	1.77E+00	MnO	MnO	1.77E+00	6.45E-02	SVOC	SVOC	1.82E-02	SVOC	1.82E-02	1.82E-02	1.82E-02	1.82E-02										
Si	2.94E+01	2.94E+01	SiO2	SiO2	2.94E+01	1.77E+00	CH3Cl	CH3Cl	2.30E-02	CH3Cl	2.30E-02	2.30E-02	2.30E-02	2.30E-02										
P	1.68E+01	1.68E+01	P	P	1.68E+01	1.45E+00	CH3Br	CH3Br	4.30E-02	CH3Br	4.30E-02	4.30E-02	4.30E-02	4.30E-02										
Sb	4.75E-03	4.75E-03	Sb2O3	Sb2O3	4.75E-03	1.60E-04	TCA	TCA	7.38E-01	TCA	7.38E-01	7.38E-01	7.38E-01	7.38E-01										
Ba	1.24E-01	1.24E-01	BaO	BaO	1.24E-01	3.91E-03	di-cl methane	di-cl methane	4.88E-03	di-cl methane	4.88E-03	4.88E-03	4.88E-03	4.88E-03										
Be	8.38E-03	8.38E-03	BeO	BeO	8.38E-03	6.57E-04	di-cl benzene	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	5.70E-03	5.70E-03	5.70E-03										
Cd	1.40E-02	1.40E-02	CdO	CdO	1.40E-02	4.51E-04																		
Pb	1.88E-01	1.88E-01	PbO2	PbO2	1.88E-01	6.12E-03																		
Hg	8.22E-01	8.22E-01	Hg	Hg	8.22E-01	1.86E-02																		
Ni	1.32E-01	1.32E-01	NiO	NiO	1.32E-01	4.74E-03																		
Ag	2.16E-01	2.16E-01	Ag2O	Ag2O	2.16E-01	6.55E-03																		
S	8.00E-06	8.00E-06	S	S	8.00E-06	Nonvolatile-SO4	Nonvolatile-SO4	2.32E-01	6.55E-03															
V	2.02E-03	2.02E-03	V2O5	V2O5	2.02E-03	6.76E-07																		
Zn	5.80E-01	5.80E-01	ZnO	ZnO	5.80E-01	1.02E-04																		
Cl (total)	3.69E-01	3.69E-01	Cl (extra)	Cl (extra)	3.69E-01	2.04E-02																		
Na	8.00E-01	8.00E-01	Na2O	Na2O	8.00E-01	0.00E+00	Nonvolatile-Cl	Nonvolatile-Cl	0.00E+00	Nonvolatile-Cl	0.00E+00	0.00E+00	0.00E+00	0.00E+00										
K	3.56E+00	3.56E+00	K2O	K2O	3.56E+00	3.04E-02																		
PCB-1260	6.41E-02	6.41E-02	PCB-1260	PCB-1260	6.41E-02	1.81E-03																		
TCE	6.03E+00	6.03E+00	TCE	TCE	6.03E+00	0.00E+00																		
PCE	1.78E-01	1.78E-01	PCE	PCE	1.78E-01	0.00E+00																		
CH3Cl	2.30E-02	2.30E-02	CH3Cl	CH3Cl	2.30E-02	0.00E+00																		
CH3Br	4.30E-02	4.30E-02	CH3Br	CH3Br	4.30E-02	0.00E+00																		
TCA	7.38E-01	7.38E-01	TCA	TCA	7.38E-01	0.00E+00																		
di-cl methane	4.88E-03	4.88E-03	di-cl methane	di-cl methane	4.88E-03	0.00E+00																		
di-cl benzene	5.70E-03	5.70E-03	di-cl benzene	di-cl benzene	5.70E-03	0.00E+00																		
BEHP	2.30E-01	2.30E-01	BEHP	BEHP	2.30E-01	1.45E-03																		
SVOC	1.82E-01	1.82E-01	SVOC	SVOC	1.82E-01	6.49E-03																		
Carbon (total)	5.31E+00	5.31E+00	Carbon (extra)	Carbon (extra)	5.31E+00	1.19E-01																		
H2O	3.05E+02	3.05E+02	H2O	H2O	3.05E+02	0.00E+00																		
TRU (C)	3.05E-02	3.05E-02	TRU (C)	TRU (C)	3.05E-02	4.25E+00																		
Cs 137 (C)	2.83E+00	2.83E+00	Cs 137 (C)	Cs 137 (C)	2.83E+00	3.05E-02																		
Sr 90 (C)	2.15E+00	2.15E+00	Sr 90 (C)	Sr 90 (C)	2.15E+00	2.15E+00																		
Soils																								
Total Dry Soil	3.39E+03	3.39E+03	Dry Soil	Dry Soil	3.39E+03	9.57E+01																		
H2O in Soil	5.76E+02	5.76E+02	H2O in Soil	H2O in Soil	5.76E+02	0.00E+00																		
Rate, L/HR	2646	2646																						
Bulk Density, Kg/Liter	1.5	1.5																						
Rate, Kg/HR	3969	3969																						
Composition	Weight %	Weight %	Component	Component	Component	Component	Component	Component	Component	Component	Component	Component	Component	Component										
CaAl2S2O8	19.74%	19.74%	CaAl2S2O8	CaAl2S2O8	19.74%																			
CaCO3	10.54%	10.54%	CaCO3	CaCO3	10.54%																			
Fe2O3	3.23%	3.23%	Fe2O3	Fe2O3	3.23%																			
MgCO3.3H2O	7.58%	7.58%	MgCO3.3H2O	MgCO3.3H2O	7.58%																			
MnCO3	0.10%	0.10%	MnCO3	MnCO3	0.10%																			
Ca3(PO4)2	0.41%	0.41%	Ca3(PO4)2	Ca3(PO4)2	0.41%																			
K2CO3	2.96%	2.96%	K2CO3	K2CO3	2.96%																			
SiO2	32.45%	32.45%	SiO2	SiO2	32.45%																			
NaAlSi3O8	8.09%	8.09%	NaAlSi3O8	NaAlSi3O8	8.09%																			
TR02	0.40%	0.40%	TR02	TR02	0.40%																			
Total Dry Soil	85.50%	85.50%	Total Dry Soil	Total Dry Soil	85.50%																			
Moisture	14.50%	14.50%	Moisture	Moisture	14.50%																			

10	
Quencher & Scrubber Feed Liquid	
Component	Kg/HR
H2O	3.05E+02

14	
ME Liquid Effluent	
Component	Kg/HR
H2O	10



On-Site TD



Off-Site TD

Stream Number	1	2-L	4	5	6	8-L	11	12	13	14&15
Stream Name	Rotary Kiln Feed Mixture (200 gal batch, 100 gallon/hr)	Rotary Kiln Solids (include metal filter solids)	Rotary Kiln Off Gas	Super Heater Off Gas	Metal Filter Off Gas	Condenser Liquid Effluent	Condenser Off Gas	ME Off Gas	Heater Off Gas	HEPA+GAC+S-GAC Off Gas
	Temperature, C Pressure, mm Hg Rate, L/Hr Density Kg/Hr	95 620 4.72E+01	Temperature Pressure Act ft3 Std ft3/hr Kg/Hr	100 610 4.85E+04 Act ft3 3.16E+04 Std ft3/hr 8.34E+02 Kg/Hr	100 610 5.02E+04 Act ft3 3.16E+04 Std ft3/hr 8.34E+02 Kg/Hr	60 570 2.36E+02 Act ft3 2.36E+02 Density, g/cc 2.36E+02 Kg/Hr	60 570 3.03E+04 Act ft3 2.03E+04 Std ft3/hr 5.92E+02 Kg/Hr	60 550 3.03E+04 Act ft3 2.03E+04 Std ft3/hr 5.92E+02 Kg/Hr	150 550 3.84E+04 Act ft3 2.03E+04 Std ft3/hr 5.92E+02 Kg/Hr	Temperature, C Pressure, mm Hg
Component	Kg/Hr	Component	Kg/Hr	Component	Kg/Hr	Component	Kg/Hr	Component	Kg/Hr	Component
Al	2.00E-01 Al2O3	3.78E-01	3.47E+02 H2O	3.47E+02 H2O	3.47E+02 H2O	2.36E+02 H2O	1.11E+02 H2O	1.06E+02 H2O	1.06E+02 H2O	1.06E+02 H2O
Ba	6.78E-01 BaO	9.46E-01	1.41E-03 TCE	1.41E-03 TCE	1.41E-03 TCE	2.82E-04 TCE	1.13E-03 TCE	1.13E-03 TCE	1.13E-03 TCE	1.13E-03 TCE
Be	3.16E-03 BeO	8.78E-03	1.67E-01 PCE	1.67E-01 PCE	1.67E-01 PCE	3.34E-02 PCE	1.34E-01 PCE	1.34E-01 PCE	1.34E-01 PCE	1.34E-01 PCE
Cd	1.46E-02 CdO	1.67E-02	4.86E+02 N2	4.86E+02 N2	4.86E+02 N2	0.00E+00 N2	4.86E+02 N2	4.86E+02 N2	4.86E+02 N2	4.86E+02 N2
Pb	1.17E-01 PbO2	1.35E-01	2.66E-02 Hg	2.66E-02 Hg	2.66E-02 Hg	1.60E-02 Hg	1.06E-02 Hg	1.06E-02 Hg	1.06E-02 Hg	1.06E-02 Hg
Hg	1.33E-01 Hg	1.06E-01	3.61E-05 SVOC	3.61E-05 SVOC	3.61E-05 SVOC	3.57E-05 SVOC	3.61E-07 SVOC	3.61E-07 SVOC	3.61E-07 SVOC	3.61E-07 SVOC
Ni	3.10E-02 NiO	3.94E-02	1.51E+05 1,2 di-cl ethylene	1.51E+05 1,2 di-cl ethylene	1.51E+05 1,2 di-cl ethylene	0.00E+00 1,2 di-cl ethylene	1.51E+05 1,2 di-cl ethylene	1.51E+05 1,2 di-cl ethylene	1.51E+05 1,2 di-cl ethylene	1.51E+05 1,2 di-cl ethylene
Ag	1.33E-02 Ag2O	1.43E-02	3.63E+01 1,2 di-cl ethylene	3.63E+01 1,2 di-cl ethylene	3.63E+01 1,2 di-cl ethylene	3.63E+01 1,2 di-cl ethylene	3.63E+01 1,2 di-cl ethylene	3.63E+01 1,2 di-cl ethylene	3.63E+01 1,2 di-cl ethylene	3.63E+01 1,2 di-cl ethylene
S	2.67E-03 Nonvolatile SO4	0.00E+00	2.38E+01	2.38E+01	2.38E+01	2.38E+01	2.38E+01	2.38E+01	2.38E+01	2.38E+01
V	6.05E-04 V2O5	1.08E-03	4.95E-03	4.95E-03	4.95E-03	4.95E-03	4.95E-03	4.95E-03	4.95E-03	4.95E-03
Zn	1.70E+00 ZnO	2.12E+00	3.88E-02	3.88E-02	3.88E-02	3.88E-02	3.88E-02	3.88E-02	3.88E-02	3.88E-02
Cl (extra)	0.00E+00 Nonvolatile Cl	0.00E+00	1.86E-02	1.86E-02	1.86E-02	1.86E-02	1.86E-02	1.86E-02	1.86E-02	1.86E-02
Na	3.84E-01 Na2O	5.18E-01	3.53E-02	3.53E-02	3.53E-02	3.53E-02	3.53E-02	3.53E-02	3.53E-02	3.53E-02
K	1.98E-01 K2O	2.39E-01	2.86E-01	2.86E-01	2.86E-01	2.86E-01	2.86E-01	2.86E-01	2.86E-01	2.86E-01
PCB-1260	1.95E-02 PCB-1260	1.95E-02	8.36E-02	8.36E-02	8.36E-02	8.36E-02	8.36E-02	8.36E-02	8.36E-02	8.36E-02
TCE	1.41E-03 TCE	0.00E+00	3.03E-02	3.03E-02	3.03E-02	3.03E-02	3.03E-02	3.03E-02	3.03E-02	3.03E-02
PCE	1.67E-01 PCE	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2 di-cl ethylene	1.51E-05 1,2 di-cl ethylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BEHP	5.29E-01 BEHP	5.29E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SVOC	3.61E-04 SVOC	3.25E-04	6.88E-04	6.88E-04	6.88E-04	6.88E-04	6.88E-04	6.88E-04	6.88E-04	6.88E-04
Carbon (extra)	8.38E+00 Hydraulic Oil	1.01E+01	2.13E+01	2.13E+01	2.13E+01	2.13E+01	2.13E+01	2.13E+01	2.13E+01	2.13E+01
H2O	3.47E+02 H2O	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		Dry Waste Total	4.72E+01	4.72E+01	4.72E+01	4.72E+01	4.72E+01	4.72E+01	4.72E+01	4.72E+01
TRU (Ci)	5.85E-03 TRU (Ci)	5.85E-03	5.85E-03	5.85E-03	5.85E-03	5.85E-03	5.85E-03	5.85E-03	5.85E-03	5.85E-03
Cs 137 (Ci)	1.02E+00 Cs 137 (Ci)	1.02E+00	1.02E+00	1.02E+00	1.02E+00	1.02E+00	1.02E+00	1.02E+00	1.02E+00	1.02E+00
Sr 90 (Ci)	5.79E-01 Sr 90 (Ci)	5.79E-01	5.79E-01	5.79E-01	5.79E-01	5.79E-01	5.79E-01	5.79E-01	5.79E-01	5.79E-01

Hg (ppm)	6.76E+01
TCE (ppm)	1.19E+00
PCE (ppm)	1.41E+02
SVOC (ppm)	1.51E+01
1,2 di-cl ethylene (ppm)	0.00E+00
Rate, L/Hr	2.36E+02

ME Liquid	
Effluent	
Component	Kg/Hr
H2O	5

Stream Number Stream Name	1 Rotary Kiln Feed Mixture (100 gal/Hr)		2-L Rotary Kiln Solids (include metal filter solids)		4 Rotary Kiln Off Gas		5 Super Heater Off Gas		6 Metal Filter Off Gas		8-L Condenser Liquid Effluent		11 Condenser Off Gas		12 ME Off Gas		13 Heater Off Gas		14&15 HEPA+GAC+S-GAC Off Gas			
	Temperature, C	Pressure, mm Hg	Rate, L/Hr	Density Kg/Hr	Temperature, C	Pressure, mm Hg	Act ft3 Std ft3/hr Kg/Hr	Act ft3 Std ft3/hr Kg/Hr	Temperature, C	Pressure, mm Hg	Temperature, C	Pressure, mm Hg	Rate, L/Hr	Act ft3 Std ft3/hr Kg/Hr	Temperature, C	Pressure, mm Hg	Act ft3 Std ft3/hr Kg/Hr	Temperature, C	Pressure, mm Hg	Act ft3 Std ft3/hr Kg/Hr	Temperature, C	Pressure, mm Hg
Component																						
Al	4.24E-01	Al2O3	8.01E-01	1.22E+00	H2O	3.38E+02	H2O	3.38E+02	H2O	3.38E+02	H2O	2.27E+02	H2O	1.11E+02	H2O	1.06E+02	H2O	1.06E+02	H2O	1.06E+02	H2O	1.06E+02
Ca	8.50E-01	CaO	1.19E+00	1.81E+00	TCE	8.00E-05	TCE	8.00E-05	TCE	8.00E-05	TCE	1.60E-05	TCE	6.40E-05	TCE	6.40E-05	TCE	6.40E-05	TCE	6.40E-05	TCE	6.40E-05
Cr	4.24E-01	Cr2O3	6.20E-01	9.45E-01	PCE	5.24E-02	PCE	5.24E-02	PCE	5.24E-02	PCE	1.05E-02	PCE	4.19E-02	PCE	4.19E-02	PCE	4.19E-02	PCE	4.19E-02	PCE	4.19E-02
Fe	2.12E+00	Fe2O3	3.03E+00	4.62E+00	N2	4.86E-02	N2	4.86E-02	N2	4.86E-02	N2	0.00E+00	N2	4.86E-02	N2	4.86E-02	N2	4.86E-02	N2	4.86E-02	N2	4.86E-02
Mg	8.50E-01	MgO	1.41E+00	2.15E+00	Hg	2.32E-02	Hg	2.32E-02	Hg	2.32E-02	Hg	1.39E-02	Hg	9.28E-03	Hg	9.28E-03	Hg	9.28E-03	Hg	9.28E-03	Hg	9.28E-03
Mn	8.50E-01	MnO	1.10E+00	1.67E+00	SVOC	1.54E-04	SVOC	1.54E-04	SVOC	1.54E-04	SVOC	1.52E-04	SVOC	1.54E-06	SVOC	1.54E-06	SVOC	1.54E-06	SVOC	1.54E-06	SVOC	1.54E-06
Si	8.50E+00	SiO2	1.82E+01	2.77E+01	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	0.00E+00	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	1.10E-04
P	5.09E+00	Nonvolatile-PO4	1.56E+01	2.38E+01	1,2 di-cl benzene	8.10E-05	1,2 di-cl benzene	8.10E-05	1,2 di-cl benzene	8.10E-05	1,2 di-cl benzene	8.02E-05	1,2 di-cl benzene	8.10E-07	1,2 di-cl benzene	8.10E-07	1,2 di-cl benzene	8.10E-07	1,2 di-cl benzene	8.10E-07	1,2 di-cl benzene	8.10E-07
Sb	2.00E-03	Sb2O3	2.40E-03	3.65E-03	Hg (ppm)		6.14E+01															
Ba	1.44E-02	BaO	1.61E-02	2.45E-02	TCE (ppm)		7.06E-02															
Be	1.60E-03	BeO	4.44E-03	6.77E-03	PCE (ppm)		4.62E+01															
Cd	1.19E-02	CdO	1.36E-02	2.07E-02	SVOC (ppm)		6.73E-01															
Pb	1.15E-01	PbO2	1.33E-01	2.02E-01	1,2 di-cl ethylene (ppm)		0.00E+00															
Hg	1.16E-01	Hg	9.28E-02	1.41E-01	1,2 di-cl benzene		3.54E-01															
Ni	2.89E-02	NiO	3.68E-02	5.61E-02	Rate, L/Hr		2.27E+02															
Ag	1.92E-02	Ag2O	2.06E-02	3.14E-02																		
S	1.10E-03	Nonvolatile SO4	3.30E-03	0.00E+00																		
V	0.00E+00	V2O5	0.00E+00	0.00E+00																		
Zn	1.59E-01	ZnO	1.98E-01	3.02E-01																		
Cl (extra)	2.56E-02	Nonvolatile Cl	2.56E-02	3.90E-02																		
Na	2.43E-01	Na2O	3.28E-01	4.99E-01																		
K	2.71E-01	K2O	3.26E-01	4.98E-01																		
PCB-1260	1.19E-02	PCB-1260	1.19E-02	1.81E-02																		
TCE	8.00E-05	TCE	0.00E+00	0.00E+00																		
PCE	5.24E-02	PCE	0.00E+00	0.00E+00																		
1,2 di-cl ethylene	1.10E-04	1,2 di-cl ethylene	0.00E+00	0.00E+00																		
1,2 di-cl benzene	8.10E-04	1,2 di-cl benzene	7.29E-04	1.11E-03																		
SVOC	1.54E-03	SVOC	1.39E-03	2.11E-03																		
BEHP	4.61E-01	BEHP	4.61E-01	7.03E-01																		
Carbon (extra)	1.83E+01	Hydraulic Oil	2.20E+01	3.35E+01																		
H2O	3.38E+02	H2O	0.00E+00	0.00E+00																		
		Total Dry Waste	6.56E+01																			
TRU (Ci)	1.94E-03	TRU (Ci)	1.94E-03																			
Cs 137 (Ci)	1.13E+00	Cs 137 (Ci)	1.13E+00																			
Sr 90 (Ci)	1.21E+00	Sr 90 (Ci)	1.21E+00																			

12	
ME Liquid	
Effluent	
Component	Kg/Hr
H2O	5

Hg (ppm)	6.14E+01
TCE (ppm)	7.06E-02
PCE (ppm)	4.62E+01
SVOC (ppm)	6.73E-01
1,2 di-cl ethylene (ppm)	0.00E+00
1,2 di-cl benzene	3.54E-01
Rate, L/Hr	2.27E+02

Stream Number Stream Name	1 Rotary Kiln Feed (200 gal batch, 100 gal/hr)		2-L Rotary Kiln Solids (include metal filter solids)		4 Rotary Kiln Off Gas		5 Super Heater Off Gas		6 Metal Filter Off Gas		8-L Condenser Liquid Effluent		11 Condenser Off Gas		12 ME Off Gas		13 Heater Off Gas		14&15 HEPA+GAC+S-GAC Off Gas			
	Temperature, C	Pressure, mmHg	Rate, L/hr	Density, g/ml	Kg/hr	Temperature, C	Pressure, mmHg	Act ft3/hr	Std ft3/hr	Rate, L/hr	Density, g/ml	Rate, L/hr	Density, g/ml	Temperature, C	Pressure, mmHg	Act ft3/hr	Std ft3/hr	Temperature, C	Pressure, mmHg	Act ft3/hr	Std ft3/hr	
Al	3.52E-01	Al2O3	6.65E-01	1.06E+00	H2O	3.36E+02	H2O	3.36E+02	H2O	3.36E+02	H2O	2.25E+02	H2O	1.11E+02	H2O	1.06E+02	H2O	150	Temperature, C	150	Temperature, C	150
Ca	8.92E-01	CaO	1.25E+00	1.99E+00	TCE	5.45E-05	TCE	5.45E-05	TCE	5.45E-05	TCE	1.09E-05	TCE	1.11E+02	H2O	1.06E+02	H2O	550	Pressure, mmHg	550	Pressure, mmHg	530
Cr	3.52E-02	Cr2O3	5.14E-02	8.22E-02	PCE	4.92E-02	PCE	4.92E-02	PCE	4.92E-02	PCE	9.84E-03	PCE	4.36E-05	TCE	4.36E-05	TCE					
Fe	2.19E+00	Fe2O3	3.13E+00	5.00E+00	N2	4.86E+02	N2	4.86E+02	N2	4.86E+02	N2	0.00E+00	N2	3.94E-02	PCE	3.94E-02	PCE					
Mg	1.32E+00	MgO	2.19E+00	3.50E+00	Hg	2.54E-02	Hg	2.54E-02	Hg	2.54E-02	Hg	1.52E-02	Hg	4.86E+02	N2	4.86E+02	N2					
Mn	4.42E-01	MnO	5.71E-01	9.12E-01	SVOC	8.21E-05	SVOC	8.21E-05	SVOC	8.21E-05	SVOC	8.13E-05	SVOC	1.02E-02	Hg	1.02E-02	Hg					
Si	8.35E+00	SiO2	1.79E+01	2.85E+01	1,2 di-cl ethylene	6.26E-05	1,2 di-cl ethylene	6.26E-05	1,2 di-cl ethylene	6.26E-05	1,2 di-cl ethylene	0.00E+00	1,2 di-cl ethylene	6.26E-05	1,2 di-cl ethylene	6.26E-05	1,2 di-cl ethylene					
P	5.71E-00	Nonvolatile-PO4	1.79E+01	2.79E+01	1,2 di-cl benzene	1.13E-04	1,2 di-cl benzene	1.13E-04	1,2 di-cl benzene	1.13E-04	1,2 di-cl benzene	1.12E-04	1,2 di-cl benzene	1.13E-04	1,2 di-cl benzene	1.13E-04	1,2 di-cl benzene					
Sb	1.30E-03	Sb2O3	1.56E-03	2.49E-03																		
Ba	1.56E-02	BaO	1.74E-02	2.78E-02																		
Be	2.03E-03	BeO	5.64E-03	9.01E-03																		
Cd	8.72E-03	CdO	9.96E-03	1.59E-02																		
Pb	9.89E-02	PbO2	1.14E-01	1.82E-01																		
Hg	1.27E-01	Hg	1.02E-01	1.62E-01																		
Ni	3.24E-02	NiO	4.12E-02	6.59E-02																		
Ag	9.46E-03	Ag2O	1.02E-02	1.62E-02																		
S	7.14E-04	Nonvolatile-SO4	2.14E-03	3.41E-03																		
V	5.92E-04	V2O5	1.06E-03	1.69E-03																		
Zn	5.09E-01	ZnO	6.34E-01	1.01E+00																		
Cl (extra)	0.00E+00	Nonvolatile-Cl	0.00E+00	0.00E+00																		
Na	1.85E-01	Na2O	2.49E-01	3.98E-01																		
K	1.09E-01	K2O	1.31E-01	2.09E-01																		
PCB-1260	1.99E-02	PCB-1260	1.99E-02	3.18E-02																		
TCE	5.45E-05	TCE	0.00E+00	0.00E+00																		
PCE	4.92E-02	PCE	0.00E+00	0.00E+00																		
1,2 di-cl ethylene	6.26E-05	1,2 di-cl ethylene	0.00E+00	0.00E+00																		
BEHP	5.96E-01	BEHP	5.96E-01	9.52E-01																		
SVOC	8.21E-04	SVOC	7.39E-04	1.18E-03																		
1,2 di-cl benzene	1.13E-03	1,2 di-cl benzene	1.02E-03	1.62E-03																		
Carbon (extra)	1.46E+01	Hydraulic Oil	1.75E+01	2.79E+01																		
H2O	3.36E+02	H2O	0.00E+00	0.00E+00																		
TRU (Ci)		Total Dry Sludge	6.26E+01																			
Cs 137 (Ci)	3.61E-03	TRU (Ci)	3.61E-03																			
Cs 137 (Ci)	9.70E-01	Cs 137 (Ci)	9.70E-01																			
Sr 90 (Ci)	2.05E+00	Sr 90 (Ci)	2.05E+00																			

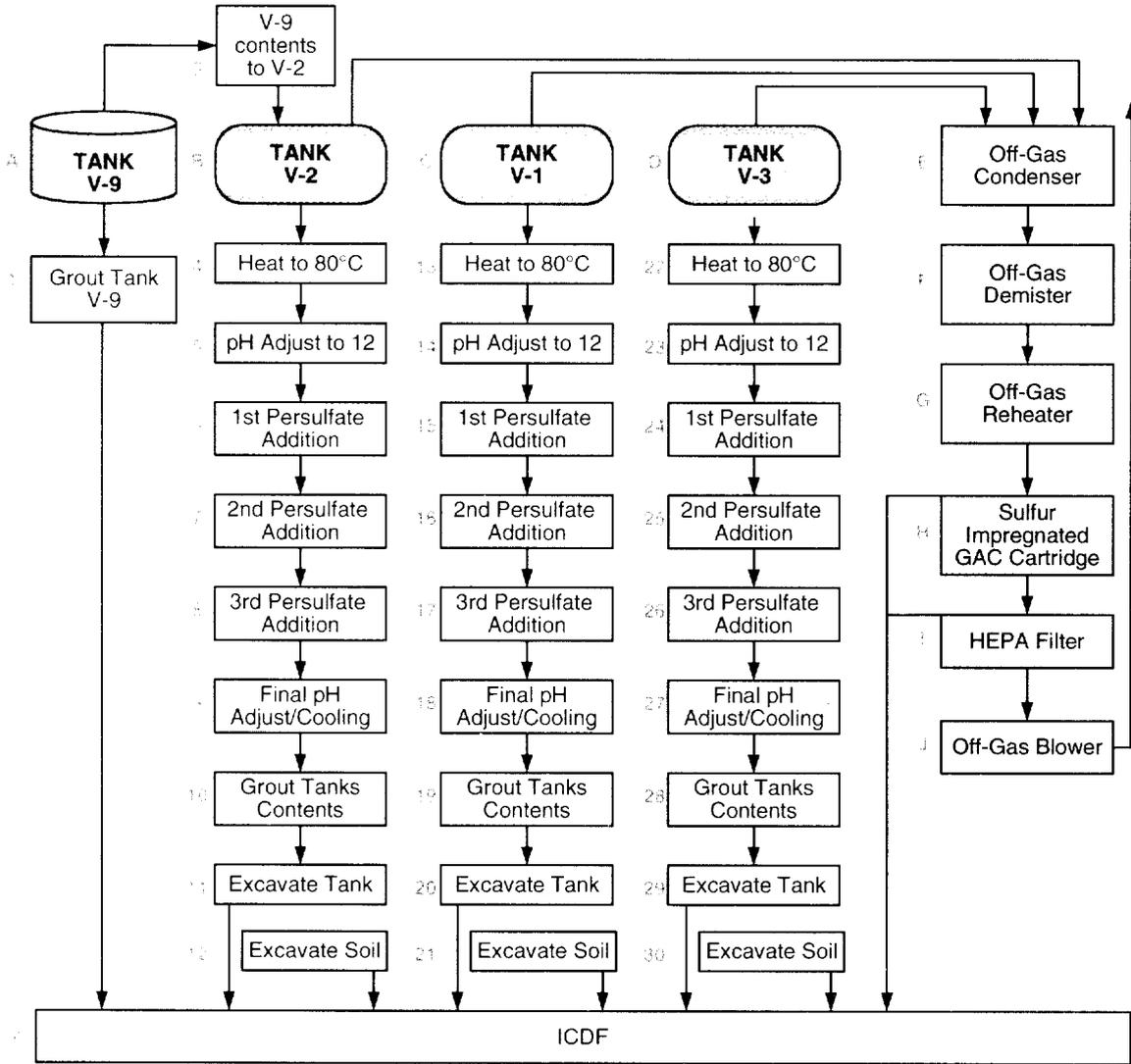
Hg (ppm)	6.77E+01
TCE (ppm)	4.84E-02
PCE (ppm)	4.37E+01
SVOC (ppm)	3.61E-01
1,2 di-cl ethylene (ppm)	0.00E+00
1,2 di-cl benzene (ppm)	4.97E-01
Rate, L/hr	2.25E+02

ME Liquid	
Effluent	
Component	Kg/hr
H2O	5

Stream Number Stream Name	1		2-L		4		5		6		8-L		11		12		13		14&15		
	Rotary Kiln Feed Mixture (100 gal/Hr)	Rotary Kiln Solids (include metal filter solids)	Rotary Kiln Solids (include metal filter solids)	Rotary Kiln Off Gas	Super Heater Off Gas	Metal Filter Off Gas	Condensate Liquid	Condenser Off Gas	ME Off Gas	Heater Off Gas	HEPA+GAC+S-GAC Off Gas	Temperature, C	Pressure, mm Hg								
	378	95	95	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
	1.094	620	620	620	620	570	570	570	570	570	570	570	570	570	570	570	570	570	570	570	570
	414	1.51E+02	1.51E+02	7.98E+02	7.98E+02	7.98E+02	1.98E+02	1.98E+02	1.98E+02	1.98E+02	1.98E+02	1.98E+02	1.98E+02	1.98E+02	1.98E+02	1.98E+02	1.98E+02	1.98E+02	1.98E+02	1.98E+02	1.98E+02
	Rate, L/Hr			Act ft3/hr	Act ft3/hr	Act ft3/hr	Rate, L/Hr	Act ft3/hr	Act ft3/hr	Act ft3/hr	Act ft3/hr	Act ft3/hr	Act ft3/hr	Act ft3/hr	Act ft3/hr	Act ft3/hr	Act ft3/hr	Act ft3/hr	Act ft3/hr	Act ft3/hr	Act ft3/hr
	Density			Std ft3/hr	Std ft3/hr	Std ft3/hr	Std ft3/hr	Std ft3/hr	Std ft3/hr	Std ft3/hr	Std ft3/hr	Std ft3/hr	Std ft3/hr	Std ft3/hr	Std ft3/hr	Std ft3/hr	Std ft3/hr	Std ft3/hr	Std ft3/hr	Std ft3/hr	Std ft3/hr
	Kg/Hr			Kg/Hr	Kg/Hr	Kg/Hr	Kg/Hr	Kg/Hr	Kg/Hr	Kg/Hr	Kg/Hr	Kg/Hr	Kg/Hr	Kg/Hr	Kg/Hr	Kg/Hr	Kg/Hr	Kg/Hr	Kg/Hr	Kg/Hr	Kg/Hr
	Component	Kg/Hr	Component	Kg/Hr	Component	Kg/Hr	Component	Kg/Hr	Component	Kg/Hr	Component	Kg/Hr	Component	Kg/Hr	Component	Kg/Hr	Component	Kg/Hr	Component	Kg/Hr	Component
	Al	1.12E+00	Al2O3	3.05E+02	H2O	3.05E+02	H2O	3.05E+02	H2O	3.05E+02	H2O	1.94E+02	H2O	1.11E+02	H2O	1.06E+02	H2O	1.06E+02	H2O	1.06E+02	H2O
	Ca	2.80E+00	CaO	6.03E+00	TCE	6.03E+00	TCE	6.03E+00	TCE	6.03E+00	TCE	1.21E+00	TCE	4.82E+00	TCE	4.82E+00	TCE	4.82E+00	TCE	4.82E+00	TCE
	Cr	7.84E-01	Cr2O3	1.76E-01	PCE	1.76E-01	PCE	1.76E-01	PCE	1.76E-01	PCE	3.52E-02	PCE	1.41E-01	PCE	1.41E-01	PCE	1.41E-01	PCE	1.41E-01	PCE
	Fe	6.06E+00	Fe2O3	8.67E+00	N2	4.86E+02	N2	4.86E+02	N2	4.86E+02	N2	0.00E+00	N2	4.86E+02	N2	4.86E+02	N2	4.86E+02	N2	4.86E+02	N2
	Mg	3.70E+00	MgO	6.14E+00	Hg	1.64E-01	Hg	1.64E-01	Hg	1.64E-01	Hg	9.86E-02	Hg	6.58E-02	Hg	6.58E-02	Hg	6.58E-02	Hg	6.58E-02	Hg
	Mn	1.77E+00	MnO	2.29E+00	SVOC	1.82E-02	SVOC	1.82E-02	SVOC	1.82E-02	SVOC	1.80E-02	SVOC	1.82E-04	SVOC	1.82E-04	SVOC	1.82E-04	SVOC	1.82E-04	SVOC
	Si	2.94E+01	SiO2	6.28E+01	CH3Cl	2.30E-02	CH3Cl	2.30E-02	CH3Cl	2.30E-02	CH3Cl	0.00E+00	CH3Cl	2.30E-02	CH3Cl	2.30E-02	CH3Cl	2.30E-02	CH3Cl	2.30E-02	CH3Cl
	P	1.68E+01	Nonvolatile-PO4	5.14E+01	CH3Br	4.30E-02	CH3Br	4.30E-02	CH3Br	4.30E-02	CH3Br	0.00E+00	CH3Br	4.30E-02	CH3Br	4.30E-02	CH3Br	4.30E-02	CH3Br	4.30E-02	CH3Br
	Sb	4.75E-03	Sb2O3	5.69E-03	TCA	7.38E-01	TCA	7.38E-01	TCA	7.38E-01	TCA	1.48E-01	TCA	5.90E-01	TCA	5.90E-01	TCA	5.90E-01	TCA	5.90E-01	TCA
	Ba	1.24E-01	BaO	1.38E-01	di-cl methane	4.88E-03	di-cl methane	4.88E-03	di-cl methane	4.88E-03	di-cl methane	0.00E+00	di-cl methane	4.88E-03	di-cl methane						
	Be	8.38E-03	BeO	2.33E-02	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.65E-03	di-cl benzene	5.70E-05	di-cl benzene						
	Cd	1.40E-02	CdO	1.60E-02	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.65E-03	di-cl benzene	5.70E-05	di-cl benzene						
	Pb	1.88E-01	PbO2	2.17E-01	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.65E-03	di-cl benzene	5.70E-05	di-cl benzene						
	Hg	8.22E-01	Hg	6.58E-01	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.65E-03	di-cl benzene	5.70E-05	di-cl benzene						
	Ni	1.32E-01	NiO	1.68E-01	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.65E-03	di-cl benzene	5.70E-05	di-cl benzene						
	Ag	2.16E-01	Ag2O	2.32E-01	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.65E-03	di-cl benzene	5.70E-05	di-cl benzene						
	S	8.00E-06	Nonvolatile-SO4	2.40E-05	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.65E-03	di-cl benzene	5.70E-05	di-cl benzene						
	V	2.02E-03	V2O5	3.61E-03	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.65E-03	di-cl benzene	5.70E-05	di-cl benzene						
	Zn	5.80E-01	ZnO	7.22E-01	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.65E-03	di-cl benzene	5.70E-05	di-cl benzene						
	Cl (extra)	0.00E+00	Nonvolatile-Cl	0.00E+00	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.65E-03	di-cl benzene	5.70E-05	di-cl benzene						
	Na	8.00E-01	Na2O	1.08E+00	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.65E-03	di-cl benzene	5.70E-05	di-cl benzene						
	K	3.56E+00	K2O	4.29E+00	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.65E-03	di-cl benzene	5.70E-05	di-cl benzene						
	PCB-1260	6.41E-02	PCB-1260	6.41E-02	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.65E-03	di-cl benzene	5.70E-05	di-cl benzene						
	TCE	6.03E+00	TCE	0.00E+00	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.65E-03	di-cl benzene	5.70E-05	di-cl benzene						
	PCE	1.76E-01	PCE	0.00E+00	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.65E-03	di-cl benzene	5.70E-05	di-cl benzene						
	CH3Cl	2.30E-02	CH3Cl	0.00E+00	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.65E-03	di-cl benzene	5.70E-05	di-cl benzene						
	CH3Br	4.30E-02	CH3Br	0.00E+00	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.65E-03	di-cl benzene	5.70E-05	di-cl benzene						
	TCA	7.38E-01	TCA	0.00E+00	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.65E-03	di-cl benzene	5.70E-05	di-cl benzene						
	di-cl methane	4.88E-03	di-cl methane	0.00E+00	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.65E-03	di-cl benzene	5.70E-05	di-cl benzene	5.70E-05	di-cl benzene	5.70E-05	di-cl methane	4.88E-03	di-cl methane
	di-cl benzene	5.70E-02	di-cl benzene	5.13E-02	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.65E-03	di-cl benzene	5.70E-05	di-cl benzene						
	BEHP	2.30E-01	BEHP	2.30E-01	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.65E-03	di-cl benzene	5.70E-05	di-cl benzene						
	SVOC	1.82E-01	SVOC	1.64E-01	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.65E-03	di-cl benzene	5.70E-05	di-cl benzene						
	Carbon (extra)	3.50E+00	Hydraulic Oil	4.20E+00	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.65E-03	di-cl benzene	5.70E-05	di-cl benzene						
	H2O	3.05E+02	H2O	0.00E+00	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.70E-03	di-cl benzene	5.65E-03	di-cl benzene	5.70E-05	di-cl benzene						
			Dry Waste Total	1.51E+02																	
	TRU (Ci)	3.05E-02	TRU (Ci)	3.05E-02																	
	Cs 137 (Ci)	2.83E+00	Cs 137 (Ci)	2.83E+00																	
	Sr 90 (Ci)	2.15E+00	Sr 90 (Ci)	2.15E+00																	

12	
ME Liquid	
Effluent	
Component	Kg/Hr
H2O	5

Hg (ppm)	5.05E+02
TCE (ppm)	6.18E+03
PCE (ppm)	1.80E+02
2-methylnaph (ppm)	9.23E+01
CH3Cl (ppm)	0.00E+00
CH3Br (ppm)	0.00E+00
TCA (ppm)	7.56E+02
di-cl methane (ppm)	0.00E+00
di-cl benzene (ppm)	2.89E+01
Rate, L/Hr	1.95E+02



In-situ CO/S

PROCESS

IN-SITU CO/S - TANK V-1

Installation of ancillary and support systems including, tank heater, AEA mixer, Instrument Probe bundle, Off-gas Treatment system, and Sodium Hydroxide and Reagent (oxidant) lines etc..

- 6 Heat tank agitation.
- 7 Add 20% Sodium Hydroxide solution to bring tank contents to pH 12
- 8 Add substoichiometric amount of sodium persulfate to initiate oxidation.
- 9 Add substoichiometric amount of sodium persulfate to further oxidation.
- 10 Add substoichiometric amount of sodium persulfate to complete oxidation.
- 11 Adjust tanks contents to pH 10.5/Cool to 70F
- 12 Grout tank contents
- 13 Tank excavation, retrieval and transport to ICDF Landfill
- 14 Excavate surrounding contaminated soil and transport to ICDF for disposal

ASSUMPTIONS

V-1 will become an In-Situ Chemical Reaction Vessel capable of withstanding the temperature, pressure, and reactive environment
 Grouted tank contents and tank can be readily extracted and transported to ICDF
 Additional grouting to completely fill tank V-1 will be done at ICDF
 50% NaOH solution specific gravity of 1.50
 TCE DRE total DRE of 99.5% with 60%, 30%, 10% of it occurring in steps 8,9,10 respectively
 PCE total DRE of 99.1% with 60%, 30%, 10% of it occurring in steps 8,9,10 respectively
 VOC & Bis(2-ethylhexyl) phthalate total DRE of 90% with 60%, 30%, 10% occurring in steps 8, 9, 10 respectively
 Arochlor total DRE of 50% with 60%, 30%, 10% of it occurring in steps 8,9,10 respectively
 SVOC and TOC total DRE of 70% with 60%, 30%, 10% of it occurring in steps 8,9,10 respectively
 If Petroset is used it will be used at a rate of 8 lbs. per gallon of waste liquid
 Bulk density of tanks is arbitrarily assumed to be 1.2 g/ml
 Assumes the use of a 28w% solution of sodium persulfate at room temperature
 Following oxidation and prior to final pH adjust that liquid contents have no buffering capacity remaining
 If cementitious grout is used it will be applied to achieve a 0.45 waste water/dry cement ratio by weight
 If cementitious grout is used the resulting wet density will be 1.72 g/cc
 SVOCs contain no chloride content
 VOCs contain an average of 85w% chloride
 That the oxidized and pH adjust liquid residuals can be successfully grouted to obtain a compressive strength meeting ICDF WAC requirement
 A 35,000 fold decrease in Mercury Concentration between grouted Mercury concentration and TCLP results

MATERIAL BALANCE VARIABLES

Bulk Density of Tank Waste	1.2
50w% NaOH solution density	1.5
First Ph adjust volumetric expansion (%)	0.4
28w% Na Persulfate solution density	1.14
First Reagent volumetric expansion (%)	20
Total SVOC DRE (%)	70
Total PCB DRE (%)	50
Total VOC DRE (%)	90
Total PCE DRE (%)	99.1
Total TCE DRE (%)	99.5
Total TOC DRE (%)	70
Second Reagent volumetric expansion (%)	10
Final Reagent volumetric expansion (%)	10
Waste Liquid/Dry Cement Mass Ratio	0.4
Wet Grout Density	1.72
w% cl in VOCs	0.85
w% cl in SVOCs	0
w% cl in Arochlor	0.608

IN-SITU CO/S - TANK V-1

MATERIAL BALANCE

Initial Tank Contents	ph adjust/heat soak		first reagent add		second reagent add		final reagent add		pH grout adjust/Cooling grout		
	End of	7	8	End of	9	10	End of	10	11	12	
Temperature C	12.7	80	80	80	80	80	80	80	21.1	21.1	
pH	7.5	12	7	4	4	4	4	2	10.5	10.5	
Relative time (hrs)	0	4	124	125.1	197.1	244	268	364	22879	22879	
Total Volume (L)	6752	6779	8135	8813	8813	8813	9491	9491	9497	9497	
w% solids	7.67	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Total Mass (kg)	8102	8143	9689	10461	10461	10461	11234	11234	11244	39352	
Antimony (kg) (+/-3/+5)	3.29E-02	3.29E-02	3.29E-02	3.29E-02	3.29E-02	3.29E-02	3.29E-02	3.29E-02	3.29E-02	3.29E-02	
Barium (kg) (+2)	2.76E-01	2.76E-01	2.76E-01	2.76E-01	2.76E-01	2.76E-01	2.76E-01	2.76E-01	2.76E-01	2.76E-01	
Beryllium (kg) (+2)	5.32E-02	5.32E-02	5.32E-02	5.32E-02	5.32E-02	5.32E-02	5.32E-02	5.32E-02	5.32E-02	5.32E-02	
Cadmium (kg) (+2)	2.46E-01	2.46E-01	2.46E-01	2.46E-01	2.46E-01	2.46E-01	2.46E-01	2.46E-01	2.46E-01	2.46E-01	6.24732 Cd TCLP
Chromium (kg) (+2,+3,+6)	3.37E+00	3.37E+00	3.37E+00	3.37E+00	3.37E+00	3.37E+00	3.37E+00	3.37E+00	3.37E+00	3.37E+00	0.000178
Cyanide (kg) (-1)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Lead (kg) (+2,+4)	1.98E+00	1.98E+00	1.98E+00	1.98E+00	1.98E+00	1.98E+00	1.98E+00	1.98E+00	1.98E+00	1.98E+00	50.2338
Mercury (kg) (+1,+2)	2.24E+00	2.24E+00	2.24E+00	2.24E+00	2.24E+00	2.24E+00	2.24E+00	2.24E+00	2.24E+00	2.24E+00	56.83704 Hg TCLP
Nickel (kg) (+2,+3)	5.22E-01	5.22E-01	5.22E-01	5.22E-01	5.22E-01	5.22E-01	5.22E-01	5.22E-01	5.22E-01	5.22E-01	
Silver (kg) (+1)	2.25E-01	2.25E-01	2.25E-01	2.25E-01	2.25E-01	2.25E-01	2.25E-01	2.25E-01	2.25E-01	2.25E-01	
Transuranics (Ci)*	9.94E-02	9.94E-02	9.94E-02	9.94E-02	9.94E-02	9.94E-02	9.94E-02	9.94E-02	9.94E-02	9.94E-02	2.524746
Cesium-137 (Ci) (+1)	1.72E+01	1.72E+01	1.72E+01	1.72E+01	1.72E+01	1.72E+01	1.72E+01	1.72E+01	1.72E+01	1.72E+01	
Strontium-90 (Ci) (+2)	9.76E+00	9.76E+00	9.76E+00	9.76E+00	9.76E+00	9.76E+00	9.76E+00	9.76E+00	9.76E+00	9.76E+00	
SVOCs (kg)	6.47E-03	6.47E-03	3.75E-03	3.75E-03	3.75E-03	3.75E-03	3.75E-03	3.75E-03	1.94E-03	1.94E-03	
Arochlor 1260 (kg)*	3.31E-01	3.31E-01	2.31E-01	2.31E-01	2.31E-01	2.31E-01	2.31E-01	2.31E-01	1.65E-01	1.65E-01	4.199582
bis (2-ethylhexyl) phthalate	8.99E+00	5.85E+00	2.69E+00	2.69E+00	1.11E+00	1.11E+00	1.11E+00	1.11E+00	5.85E-01	5.85E-01	14.86568
VOCs (kg)	2.56E-04	2.56E-04	1.18E-04	1.18E-04	1.18E-04	1.18E-04	1.18E-04	1.18E-04	2.56E-05	2.56E-05	
Tetrachloroethylene (kg)	2.81E+00	2.81E+00	1.14E+00	1.14E+00	3.03E-01	3.03E-01	3.03E-01	3.03E-01	2.53E-02	2.53E-02	0.641672
Trichloroethylene (kg)	2.37E-02	2.37E-02	9.57E-03	9.57E-03	2.48E-03	2.48E-03	2.48E-03	2.48E-03	1.19E-04	1.19E-04	0.003017
TOC (kg)*	1.48E+02	1.48E+02	8.61E+01	8.61E+01	5.49E+01	5.49E+01	5.49E+01	5.49E+01	4.45E+01	4.45E+01	
chlorides (kg)*	4.29E+00	4.29E+00	5.79E+00	5.79E+00	6.54E+00	6.54E+00	6.54E+00	6.54E+00	6.79E+00	6.79E+00	
carbon dioxide	0	0	2.29E+02	2.29E+02	3.43E+02	3.43E+02	3.43E+02	3.43E+02	3.81E+02	3.81E+02	

*Priority Contaminants

chloride concentration (mg/l)

635.3672986

632.8959548

527.3632956

711.5422561

656.8082364

715.1384827

688.8272026

741.8139105

688.8272026

714.6666322

296.6481965

PROCESS

IN-SITU CO/S - TANK V-2 AND V-9

Installation of ancillary and support systems including, tank heater, AEA mixer, Instrument Probe bundle, Off-gas Treatment system, and Sodium Hydroxide and Reagent (oxidant) lines etc.
Start continuous tank agitation.

- 4 Remove contents of tank V-9 and add to contents of V-2
- 16 Heat tank contents to 80C.
- 17 Add 20% Sodium Hydroxide solution to bring tank contents to pH 12
Maintain temperature and agitation to facilitate "heat soak" pretreatment.
- 18 Add substoichiometric amount of sodium persulfate to initiate oxidation.
Monitor initial reaction progress by pH probe.
- 19 Add substoichiometric amount of sodium persulfate to further oxidation.
Monitor further reaction progress by pH probe.
- 20 Add substoichiometric amount of sodium persulfate to complete oxidation.
Monitor final reaction progress by pH probe.
- 21 Adjust tanks contents to pH 10.5/Cool to 70F
Saver connection to in-tank equipment (leave in place "in-tank" components)
- 22 Grout tank contents
Grout sample collection and analysis for compliance evaluation.
- 23 Tank excavation, retrieval and transportation to ICDF Landfill
- 24 Excavate surrounding contaminated soil and transport to ICDF for disposal.
Fill remaining "free-board" in tank V-2 with grout at ICDF and dispose of tank.

ASSUMPTIONS

V-2 will become an In-Situ Chemical Reaction Vessel capable of withstanding the temperature, pressure, and reactive environment
Grouted tank contents and tank can be readily extracted and transported to ICDF
Additional grouting to completely fill tank V-2 will be done at ICDF
50% NaOH solution specific gravity of 1.50
TCE total DRE of 99.5% with 60%, 30%, 10% of it occurring in steps 8,9,10 respectively
PCE total DRE of 99.1% with 60%, 30%, 10% of it occurring in steps 18,19, 20 respectively
VOC & Bis(2-ethylhexyl phthalate total DRE of 90% with 60%, 30%, 10% occurring in steps 18, 19, 20 respectively
Arochlor total DRE of 50% with 60%, 30%, 10% of it occurring in steps 18,19, 20 respectively
SVOC and TOC total DRE of 70% with 60%, 30%, 10% of it occurring in steps 18,19, 20 respectively
If Petroset is used it will be used at a rate of 8 lbs. per gallon of waste liquid
Bulk density of tanks is arbitrarily assumed to be 1.2 g/ml
Assumes the use of a 28w% solution of sodium persulfate at room temperature
Following oxidation and prior to final pH adjust that liquid contents have no buffering capacity remaining
If cementitious grout is used it will be applied to achieve a 0.45 waste water/dry cement ratio by weight
If cementitious grout is used the resulting wet density will be 1.72 g/cc
SVOCs contain no chloride content
VOCs contain an average of 85w% chloride
That the oxidized and pH adjust liquid residuals can be successfully grouted to obtain a compressive strength meeting ICDF WAC requirement
A 35,000 fold decrease in Mercury Concentration between grouted Mercury concentration and TCLP results

MATERIAL BALANCE VARIABLES

Bulk Density of Tank Waste	1.2
50w% NaOH solution density	1.5
First Ph adjust volumetric expansion (%)	0.4
28w% Na Persulfate solution density	1.14
First Reagent volumetric expansion (%)	20
Total SVOC DRE (%)	70
Total PCB DRE (%)	90
Total bis(2-ethylhexyl) phthalate DRE (%)	90
Total VOC DRE (%)	99.1
Total PCE DRE (%)	99.5
Total TCE DRE (%)	70
Total TOC DRE (%)	10
Second Reagent volumetric expansion (%)	10
Final Reagent volumetric expansion (%)	0.4
Waste Liquid/Dry Cement Mass Ratio	1.72
Wet Grout Density	0.85
w% cl in VOCs	0
w% cl in SVOCs	0
w% cl in Arochlor	0.608

IN-SITU CO/S - TANK V-2 AND V-9

MATERIAL BALANCE

Initial Tank Contents	pH adjust/heat soak		first reagent add		second reagent add		final reagent add		pH grout adjust/Cooling		grout
	End of	7	End of	8	End of	9	End of	10	11	12	
Temperature C	12.7	80	80	80	80	80	80	80	80	21.1	21.1
pH	7.5	12	7	7	7	7	4	4	2	10.5	10.5
Relative time (hrs)	0	4	6.4	124	125.1	196	197.1	244	268	364	364
Total Volume (L)	7250	7279	8735	8735	9463	9463	10191	10191	10197	24567	24567
w% solids	10.29	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.409138638
Total Mass (kg)	8700	8744	10403	10403	11233	11233	12063	12063	12073	42255	42255
Antimony (kg) (+/-3,+/-5)	4.77E-02	4.77E-02	4.77E-02	4.77E-02	4.77E-02	4.77E-02	4.77E-02	4.77E-02	4.77E-02	4.77E-02	4.77E-02
Barium (kg) (+2)	6.28E-01	6.28E-01	6.28E-01	6.28E-01	6.28E-01	6.28E-01	6.28E-01	6.28E-01	6.28E-01	6.28E-01	6.28E-01
Beryllium (kg) (+2)	5.22E-02	5.22E-02	5.22E-02	5.22E-02	5.22E-02	5.22E-02	5.22E-02	5.22E-02	5.22E-02	5.22E-02	5.22E-02
Cadmium (kg)* (+2)	2.35E-01	2.35E-01	2.35E-01	2.35E-01	2.35E-01	2.35E-01	2.35E-01	2.35E-01	2.35E-01	2.35E-01	2.35E-01
Chromium (kg) (+2,+3,+6)	9.29E+00	9.29E+00	9.29E+00	9.29E+00	9.29E+00	9.29E+00	9.29E+00	9.29E+00	9.29E+00	9.29E+00	9.29E+00
Cyanide (kg) (-1)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Lead (kg) (+2,+4)	2.44E+00	2.44E+00	2.44E+00	2.44E+00	2.44E+00	2.44E+00	2.44E+00	2.44E+00	2.44E+00	2.44E+00	2.44E+00
Mercury (kg)* (+1,+2)	4.49E+00	4.49E+00	4.49E+00	4.49E+00	4.49E+00	4.49E+00	4.49E+00	4.49E+00	4.49E+00	4.49E+00	4.49E+00
Nickel (kg) (+2,+3)	8.86E-01	8.86E-01	8.86E-01	8.86E-01	8.86E-01	8.86E-01	8.86E-01	8.86E-01	8.86E-01	8.86E-01	8.86E-01
Silver (kg) (+1)	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Transuranics (Ci)*	1.29E-01	1.29E-01	1.29E-01	1.29E-01	1.29E-01	1.29E-01	1.29E-01	1.29E-01	1.29E-01	1.29E-01	1.29E-01
Cesium-137 (Ci)* (+1)	2.71E+01	2.71E+01	2.71E+01	2.71E+01	2.71E+01	2.71E+01	2.71E+01	2.71E+01	2.71E+01	2.71E+01	2.71E+01
Strontium-90 (Ci) (+2)	2.63E+01	2.63E+01	2.63E+01	2.63E+01	2.63E+01	2.63E+01	2.63E+01	2.63E+01	2.63E+01	2.63E+01	2.63E+01
SVOCs (kg)	1.77E+00	1.77E+00	1.77E+00	1.03E+00	1.03E+00	1.03E+00	6.56E-01	6.56E-01	5.32E-01	5.32E-01	5.32E-01
Arochlor 1260 (kg)*	3.96E-01	3.96E-01	3.96E-01	2.77E-01	2.77E-01	2.77E-01	2.18E-01	2.18E-01	1.98E-01	1.98E-01	1.98E-01
bis (2-ethylhexyl) phthalate	8.12E+00	8.12E+00	8.12E+00	3.73E+00	3.73E+00	3.73E+00	1.54E+00	1.54E+00	8.12E-01	8.12E-01	8.12E-01
VOCs (kg)	2.59E+00	2.59E+00	2.59E+00	1.19E+00	1.19E+00	1.19E+00	4.92E-01	4.92E-01	2.59E-01	2.59E-01	2.59E-01
Tetrachloroethylene (kg)	1.40E+00	1.40E+00	1.40E+00	5.69E-01	5.69E-01	5.69E-01	1.52E-01	1.52E-01	1.26E-02	1.26E-02	1.26E-02
Trichloroethylene (kg)	1.93E+01	1.93E+01	1.93E+01	7.77E+00	7.77E+00	7.77E+00	2.02E+00	2.02E+00	9.64E-02	9.64E-02	9.64E-02
TOC (kg)*	3.16E+02	3.16E+02	3.16E+02	1.83E+02	1.83E+02	1.83E+02	1.17E+02	1.17E+02	9.49E+01	9.49E+01	9.49E+01
chlorides (kg)*	4.56E+01	4.56E+01	4.56E+01	5.69E+01	5.69E+01	5.69E+01	6.26E+01	6.26E+01	6.44E+01	6.44E+01	6.44E+01
carbon dioxide	0	0	0	4.87E+02	4.87E+02	4.87E+02	7.31E+02	7.31E+02	8.12E+02	8.12E+02	8.12E+02

*Priority Contaminants

chloride concentration (mg/l)

6289.655172	6264.596785	5220.497321	6514.334603	6013.231941	6610.387609	6138.217066	6323.050963	6318.878996	2622.878939
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PROCESS

IN-SITU CO/S - TANK V-3

Installation of ancillary and support systems including, tank heater, AEA mixer, Instrument Probe bundle, Off-gas Treatment system, and Sodium Hydroxide and Reagent (oxidant) lines etc.
Start continuous tank agitation.

- 26 Heat tank contents to 80C.
- 27 Add 20% Sodium Hydroxide solution to bring tank contents to pH 12
Maintain temperature and agitation to facilitate "heat soak" pretreatment.
- 28 Add substoichiometric amount of sodium persulfate to initiate oxidation.
Monitor initial reaction progress by pH probe.
- 29 Add substoichiometric amount of sodium persulfate to further oxidation.
Monitor further reaction progress by pH probe.
- 30 Add substoichiometric amount of sodium persulfate to complete oxidation.
Monitor final reaction progress by pH probe.
- 31 Verify critical COC concentrations through sampling and analysis
Adjust tanks contents to pH 10.5/Cool to 70F
- 32 Sever connection to in-tank equipment (leave in place "in-tank" components)
Grout tank contents
- 33 Grout sample collection and analysis for compliance evaluation.
- 33 Tank excavation, retrieval and transportation to ICDF Landfill
- Dismantle ancillary and support systems and transport to ICDF for disposal.
- 34 Excavate surrounding contaminated soil and transport to ICDF for disposal
Fill remaining "free-board" in tank V-1 with grout at ICDF and dispose of tank.

ASSUMPTIONS

6,000 gallons of supernate liquid will be decanted from tank V-3 prior to tank remediation
V-3 will become an In-Situ Chemical Reaction Vessel capable of withstanding the temperature, pressure, and reactive environment
Grouted tank contents and tank can be readily extracted and transported to ICDF
Additional grouting to completely fill tank V-3 will be done at ICDF
50% NaOH solution specific gravity of 1.50
That the oxidized and pH adjust liquid residuals can be successfully grouted to obtain a compressive strength meeting ICDF WAC requirement
TCE total DRE of 99.5% with 60%, 30%, 10% of it occurring in steps 28,29, 30 respectively
PCE total DRE of 99.1% with 60%, 30%, 10% of it occurring in steps 28,29, 30 respectively
VOC & Bis(2-ethylhexyl) phthalate total DRE of 90% with 60%, 30%, 10% occurring in steps 28, 29, 30 respectively
Arochlor total DRE of 50% with 60%, 30%, 10% of it occurring in steps 28,29, 30 respectively
SVOC and TOC total DRE of 70% with 60%, 30%, 10% of it occurring in steps 28,29, 30 respectively
If Petroset is used it will be used at a rate of 8 lbs. per gallon of waste liquid
Bulk density of tanks is arbitrarily assumed to be 1.2 g/ml
Assumes the use of a 28w% solution of sodium persulfate at room temperature
Following oxidation and prior to final pH adjust that liquid contents have no buffering capacity remaining
If cementitious grout is used it will be applied to achieve a 0.45 waste water/dry cement ratio by weight
If cementitious grout is used the resulting wet density will be 1.72 g/cc
SVOCs contain no chloride content
VOCs contain an average of 85w% chloride
That the oxidized and pH adjust liquid residuals can be successfully grouted to obtain a compressive strength meeting ICDF WAC requirement
A 35,000 fold decrease in Mercury Concentration between grouted Mercury concentration and TCLP results

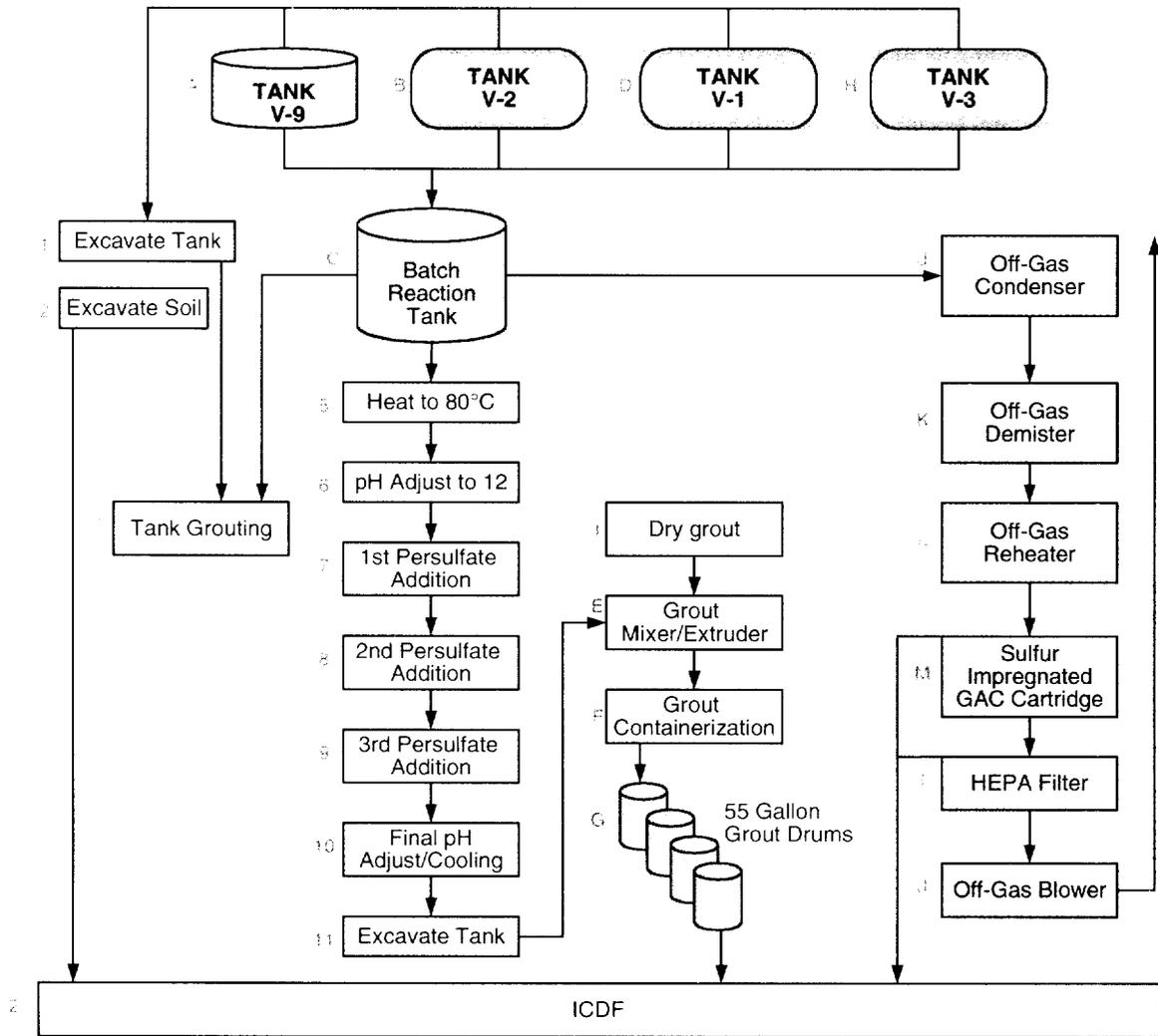
MATERIAL BALANCE VARIABLES

Bulk Density of Tank Waste	1.2
50w% NaOH solution density	1.5
First Ph adjust volumetric expansion (%)	0.4
28w% Na Persulfate solution density	1.14
First Reagent volumetric expansion (%)	20
Total SVOC DRE (%)	70
Total PCB DRE (%)	50
Total bis(2-ethylhexyl) phthalate DRE (%)	90
Total VOC DRE (%)	90
Total PCE DRE (%)	99.1
Total TCE DRE (%)	99.5
Total TOC DRE (%)	70
Second Reagent volumetric expansion (%)	10
Final Reagent volumetric expansion (%)	10
Waste Liquid/Dry Cement Mass Ratio	0.4
Wet Grout Density	1.72
w% cl in VOCs	0.85
w% cl in SVOCs	0
w% cl in Arochlor	0.608

IN-SITU CO/S - TANK V-3

MATERIAL BALANCE

Initial Tank Contents	ph adjust/heat soak		first reagent add		second reagent add		final reagent add		pH grout adjust/cooling grout		
	End of	7	End of	8	End of	9	End of	10	End of	11	12
Temperature C		80	80	80	80	80	80	80	80	21.1	21.1
pH	12.7	12	12	7	7	7	4	2	2	10.5	10.5
Relative time (hrs)	0	4	6.4	124	125.1	196	197.1	244	244	268	364
Total Volume (L)	8706	8741	10489	10489	11363	11363	12237	12237	12237	12245	29500
w% solids	11.06 NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Mass (kg)	10447	10499	12492	12492	13489	13489	14485	14485	14485	14497	50741
Antimony (kg) (+/-3/+5)	3.02E-02	3.02E-02	3.02E-02	3.02E-02	3.02E-02	3.02E-02	3.02E-02	3.02E-02	3.02E-02	3.02E-02	3.02E-02
Barium (kg) (+2)	3.62E-01	3.62E-01	3.62E-01	3.62E-01	3.62E-01	3.62E-01	3.62E-01	3.62E-01	3.62E-01	3.62E-01	3.62E-01
Beryllium (kg) (+2)	4.69E-02	4.69E-02	4.69E-02	4.69E-02	4.69E-02	4.69E-02	4.69E-02	4.69E-02	4.69E-02	4.69E-02	4.69E-02
Cadmium (kg) (+2)	2.02E-01	2.02E-01	2.02E-01	2.02E-01	2.02E-01	2.02E-01	2.02E-01	2.02E-01	2.02E-01	2.02E-01	2.02E-01
Chromium (kg) (+2,+3,+6)	8.12E-01	8.12E-01	8.12E-01	8.12E-01	8.12E-01	8.12E-01	8.12E-01	8.12E-01	8.12E-01	8.12E-01	8.12E-01
Cyanide (kg) (-1)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Lead (kg) (+2,+4)	2.29E+00	2.29E+00	2.29E+00	2.29E+00	2.29E+00	2.29E+00	2.29E+00	2.29E+00	2.29E+00	2.29E+00	2.29E+00
Mercury (kg) (+1,+2)	2.93E+00	2.93E+00	2.93E+00	2.93E+00	2.93E+00	2.93E+00	2.93E+00	2.93E+00	2.93E+00	2.93E+00	2.93E+00
Nickel (kg) (+1)	7.50E-01	7.50E-01	7.50E-01	7.50E-01	7.50E-01	7.50E-01	7.50E-01	7.50E-01	7.50E-01	7.50E-01	7.50E-01
Silver (kg) (+1)	2.19E-01	2.19E-01	2.19E-01	2.19E-01	2.19E-01	2.19E-01	2.19E-01	2.19E-01	2.19E-01	2.19E-01	2.19E-01
Transuranics (Ci)*	8.36E-02	8.36E-02	8.36E-02	8.36E-02	8.36E-02	8.36E-02	8.36E-02	8.36E-02	8.36E-02	8.36E-02	8.36E-02
Cesium-137 (Ci) (+1)	2.23E+01	2.23E+01	2.23E+01	2.23E+01	2.23E+01	2.23E+01	2.23E+01	2.23E+01	2.23E+01	2.23E+01	2.23E+01
Strontium-90 (Ci) (+2)	4.72E+01	4.72E+01	4.72E+01	4.72E+01	4.72E+01	4.72E+01	4.72E+01	4.72E+01	4.72E+01	4.72E+01	4.72E+01
SVOCS (kg)	4.57E-02	4.57E-02	4.57E-02	4.57E-02	4.57E-02	4.57E-02	4.57E-02	4.57E-02	4.57E-02	4.57E-02	4.57E-02
Arochlor 1260 (kg)*	4.60E-01	4.60E-01	4.60E-01	4.60E-01	4.60E-01	4.60E-01	4.60E-01	4.60E-01	4.60E-01	4.60E-01	4.60E-01
bis (2-ethylhexyl) phthalate	1.37E+01	1.37E+01	1.37E+01	1.37E+01	1.37E+01	1.37E+01	1.37E+01	1.37E+01	1.37E+01	1.37E+01	1.37E+01
VOCs (kg)	1.45E-03	1.45E-03	1.45E-03	1.45E-03	1.45E-03	1.45E-03	1.45E-03	1.45E-03	1.45E-03	1.45E-03	1.45E-03
Tetrachloroethylene (kg)	1.14E+00	1.14E+00	1.14E+00	1.14E+00	1.14E+00	1.14E+00	1.14E+00	1.14E+00	1.14E+00	1.14E+00	1.14E+00
Trichloroethylene (kg)	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03	1.26E-03
TOC (kg)*	3.45E+02	3.45E+02	3.45E+02	3.45E+02	3.45E+02	3.45E+02	3.45E+02	3.45E+02	3.45E+02	3.45E+02	3.45E+02
chlorides (kg)*	1.94E+00	1.94E+00	1.94E+00	1.94E+00	1.94E+00	1.94E+00	1.94E+00	1.94E+00	1.94E+00	1.94E+00	1.94E+00
carbon dioxide	0	0	0	0	0	0	0	0	0	0	0
*Priority Contaminants											
chloride concentration (mg/l)	222.8348266	221.9470384	184.9558653	248.4797277	229.3659025	258.6846083	240.2071362	249.2819737	249.1174967	103.4052141	



Ex-situ CO/S

PROCESS

EX-SITU CO/S - TANK V-1

Installation of ancillary and support systems including, reaction vessel, AEA mixer, Instrument Probe bundle, Off-gas Treatment system, and Sodium Hydroxide and Reagent (oxidant) lines etc..

- C Pump contents of tank V-1 into reaction vessel
 - Start continuous tank agitation.
- 5 initiate reaction vessel agitation and heat tanks contents to 80C
- 6 Add 20% Sodium Hydroxide solution to bring reaction vessel contents to pH 12
Maintain temperature and agitation to facilitate "heat soak" pretreatment.
- 7 Add substoichiometric amount of sodium persulfate to initiate oxidation.
Monitor initial reaction progress by pH probe.
- 8 Add substoichiometric amount of sodium persulfate to further oxidation.
Monitor further reaction progress by pH probe.
- 9 Add substoichiometric amount of sodium persulfate to complete oxidation.
Monitor final reaction progress by pH probe.
- 10 Adjust reaction tank contents to pH 10.5/Cool to 70F
- 11 Pump oxidized liquids from reaction vessel to grout mixer/extruder
- E Grout oxidized liquid waste
- F Extrude and contained grouted waste into 55 gallons drums
Grout sample collection and analysis for compliance evaluation.
- 1 Tank V-1 excavation, retrieval and transport to ICDF Landfill
- 2 Dismantle ancillary and support systems and transport to ICDF for disposal.
- 3 Excavate surrounding contaminated soil and transport to ICDF for disposal
- 3 Fill tank V-1 with grout at ICDF and dispose of tank.

ASSUMPTIONS

Empty tank V-1 can be readily extracted and transported to ICDF
Grouting to fill tank V-1 will be done at the ICDF
50% NaOH solution specific gravity of 1.50
TCE total DRE of 99.5% with 60%, 30%, 10% of it occurring in steps 28,29, 30 respectively
PCE total DRE of 99.1% with 60%, 30%, 10% of it occurring in steps 8,9,10 respectively
VOC & Bis(2-ethylhexyl) phthalate total DRE of 90% with 60%, 30%, 10% occurring in steps 8, 9, 10 respectively
Arochlor total DRE of 50% with 60%, 30%, 10% of it occurring in steps 8,9,10 respectively
SVOC and TOC total DRE of 70% with 60%, 30%, 10% of it occurring in steps 8,9,10 respectively
If Petroset is used it will be used at a rate of 8 lbs. per gallon of waste liquid
Bulk density of tanks is arbitrarily assumed to be 1.2 g/ml
Assumes the use of a 28w% solution of sodium persulfate at room temperature
Following oxidation and prior to final pH adjust that liquid contents have no buffering capacity remaining
If cementitious grout is used it will be applied to achieve a 0.45 waste water/dry cement ratio by weight
If cementitious grout is used the resulting wet density will be 1.72 g/cc
SVOCs contain no chloride content
VOCs contain an average of 85w% chloride
That the oxidized and pH adjust liquid residuals can be successfully grouted to obtain a compressive strength meeting ICDF WAC requirement
A 35,000 fold decrease in Mercury Concentration between grouted Mercury concentration and TCLP results

MATERIAL BALANCE VARIABLES

Bulk Density of Tank Waste	1.2
50w% NaOH solution density	1.5
First Ph adjust volumetric expansion (%)	0.4
28w% Na Persulfate solution density	1.14
First Reagent volumetric expansion (%)	20
Total SVOC DRE (%)	70
Total PCB DRE (%)	50
Total bis(2-ethylhexyl) phthalate DRE (%)	90
Total VOC DRE (%)	90
Total PCE DRE (%)	99.1
Total TCE DRE (%)	99.5
Total TOC DRE (%)	70
Second Reagent volumetric expansion (%)	10
Final Reagent volumetric expansion (%)	10
Waste Liquid/Dry Cement Mass Ratio	0.45
Wet Grout Density	1.72
w% cl in VOCs	0.85
w% cl in SVOCs	0
w% cl in Arochlor	0.608

EX-SITU CO/S - TANK V-1

MATERIAL BALANCE

Initial Tank Contents	ph adjust/heat soak		first reagent add		second reagent add		final reagent add		pH grout adjust/Cooling grout		
	End of	7	8	End of	8	9	End of	9	10	11	12
Temperature C	12.7	80	80	80	80	80	80	80	80	21.1	21.1
pH	7.5	12	12	7	4	4	4	4	2	10.5	10.5
Relative time (hrs)	0	4	6.4	124	125.1	196	197.1	244	268	364	364
Total Volume (L)	6752	6779	8135	8135	8813	8813	9491	9491	9497	9497	21063
w% solids	7.67	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Mass (kg)	8102	8143	9689	9689	10461	10461	11234	11234	11234	11244	96229
Antimony (kg) (+/-3/+5)	3.29E-02	3.29E-02	3.29E-02	3.29E-02	3.29E-02	3.29E-02	3.29E-02	3.29E-02	3.29E-02	3.29E-02	3.29E-02
Barium (kg) (+2)	2.76E-01	2.76E-01	2.76E-01	2.76E-01	2.76E-01	2.76E-01	2.76E-01	2.76E-01	2.76E-01	2.76E-01	2.76E-01
Beryllium (kg) (+2)	5.32E-02	5.32E-02	5.32E-02	5.32E-02	5.32E-02	5.32E-02	5.32E-02	5.32E-02	5.32E-02	5.32E-02	5.32E-02
Cadmium (kg)* (+2)	2.46E-01	2.46E-01	2.46E-01	2.46E-01	2.46E-01	2.46E-01	2.46E-01	2.46E-01	2.46E-01	2.46E-01	2.46E-01
Chromium (kg) (+2,+3,+6)	3.37E+00	3.37E+00	3.37E+00	3.37E+00	3.37E+00	3.37E+00	3.37E+00	3.37E+00	3.37E+00	3.37E+00	3.37E+00
Chromium (kg) (-1)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cyanide (kg) (+2,+4)	1.98E+00	1.98E+00	1.98E+00	1.98E+00	1.98E+00	1.98E+00	1.98E+00	1.98E+00	1.98E+00	1.98E+00	1.98E+00
Lead (kg) (+2,+4)	2.24E+00	2.24E+00	2.24E+00	2.24E+00	2.24E+00	2.24E+00	2.24E+00	2.24E+00	2.24E+00	2.24E+00	2.24E+00
Mercury (kg)* (+1,+2)	5.22E-01	5.22E-01	5.22E-01	5.22E-01	5.22E-01	5.22E-01	5.22E-01	5.22E-01	5.22E-01	5.22E-01	5.22E-01
Nickel (kg) (+2,+3)	2.25E-01	2.25E-01	2.25E-01	2.25E-01	2.25E-01	2.25E-01	2.25E-01	2.25E-01	2.25E-01	2.25E-01	2.25E-01
Silver (kg) (+1)	9.94E-02	9.94E-02	9.94E-02	9.94E-02	9.94E-02	9.94E-02	9.94E-02	9.94E-02	9.94E-02	9.94E-02	9.94E-02
Transuranics (Ci)*	1.72E+01	1.72E+01	1.72E+01	1.72E+01	1.72E+01	1.72E+01	1.72E+01	1.72E+01	1.72E+01	1.72E+01	1.72E+01
Cesium-137 (Ci)* (+1)	9.76E+00	9.76E+00	9.76E+00	9.76E+00	9.76E+00	9.76E+00	9.76E+00	9.76E+00	9.76E+00	9.76E+00	9.76E+00
Strontium-90 (Ci) (+2)	6.47E-03	6.47E-03	6.47E-03	6.47E-03	6.47E-03	6.47E-03	6.47E-03	6.47E-03	6.47E-03	6.47E-03	6.47E-03
SVOCS (kg)	3.31E-01	3.31E-01	3.31E-01	3.31E-01	3.31E-01	3.31E-01	3.31E-01	3.31E-01	3.31E-01	3.31E-01	3.31E-01
Arochlor 1260 (kg)*	8.99E+00	8.99E+00	8.99E+00	8.99E+00	8.99E+00	8.99E+00	8.99E+00	8.99E+00	8.99E+00	8.99E+00	8.99E+00
bis (2-ethylhexyl) phthalate	2.56E-04	2.56E-04	2.56E-04	2.56E-04	2.56E-04	2.56E-04	2.56E-04	2.56E-04	2.56E-04	2.56E-04	2.56E-04
VOCs (kg)	2.81E+00	2.81E+00	2.81E+00	2.81E+00	2.81E+00	2.81E+00	2.81E+00	2.81E+00	2.81E+00	2.81E+00	2.81E+00
Tetrachloroethylene (kg)	2.37E-02	2.37E-02	2.37E-02	2.37E-02	2.37E-02	2.37E-02	2.37E-02	2.37E-02	2.37E-02	2.37E-02	2.37E-02
Trichloroethylene (kg)	1.48E+02	1.48E+02	1.48E+02	1.48E+02	1.48E+02	1.48E+02	1.48E+02	1.48E+02	1.48E+02	1.48E+02	1.48E+02
TOC (kg)*	4.29E+00	4.29E+00	4.29E+00	4.29E+00	4.29E+00	4.29E+00	4.29E+00	4.29E+00	4.29E+00	4.29E+00	4.29E+00
chlorides (kg)*	0	0	0	0	0	0	0	0	0	0	0
carbon dioxide	6.35E+02	6.35E+02	6.35E+02	6.35E+02	6.35E+02	6.35E+02	6.35E+02	6.35E+02	6.35E+02	6.35E+02	6.35E+02
chloride concentration (mg/l)	6.35E+02	6.35E+02	6.35E+02	6.35E+02	6.35E+02	6.35E+02	6.35E+02	6.35E+02	6.35E+02	6.35E+02	6.35E+02
6.785882 Cd TCLP	0.000194	0.000194	0.000194	0.000194	0.000194	0.000194	0.000194	0.000194	0.000194	0.000194	0.000194
61.73678 Hg TCLP	0.001764	0.001764	0.001764	0.001764	0.001764	0.001764	0.001764	0.001764	0.001764	0.001764	0.001764
2.742396	2.742396	2.742396	2.742396	2.742396	2.742396	2.742396	2.742396	2.742396	2.742396	2.742396	2.742396
4.561615	4.561615	4.561615	4.561615	4.561615	4.561615	4.561615	4.561615	4.561615	4.561615	4.561615	4.561615
16.1472	16.1472	16.1472	16.1472	16.1472	16.1472	16.1472	16.1472	16.1472	16.1472	16.1472	16.1472
1.94E-03	1.94E-03	1.94E-03	1.94E-03	1.94E-03	1.94E-03	1.94E-03	1.94E-03	1.94E-03	1.94E-03	1.94E-03	1.94E-03
1.65E-01	1.65E-01	1.65E-01	1.65E-01	1.65E-01	1.65E-01	1.65E-01	1.65E-01	1.65E-01	1.65E-01	1.65E-01	1.65E-01
5.85E-01	5.85E-01	5.85E-01	5.85E-01	5.85E-01	5.85E-01	5.85E-01	5.85E-01	5.85E-01	5.85E-01	5.85E-01	5.85E-01
2.56E-05	2.56E-05	2.56E-05	2.56E-05	2.56E-05	2.56E-05	2.56E-05	2.56E-05	2.56E-05	2.56E-05	2.56E-05	2.56E-05
2.53E-02	2.53E-02	2.53E-02	2.53E-02	2.53E-02	2.53E-02	2.53E-02	2.53E-02	2.53E-02	2.53E-02	2.53E-02	2.53E-02
1.19E-04	1.19E-04	1.19E-04	1.19E-04	1.19E-04	1.19E-04	1.19E-04	1.19E-04	1.19E-04	1.19E-04	1.19E-04	1.19E-04
4.45E+01	4.45E+01	4.45E+01	4.45E+01	4.45E+01	4.45E+01	4.45E+01	4.45E+01	4.45E+01	4.45E+01	4.45E+01	4.45E+01
6.79E+00	6.79E+00	6.79E+00	6.79E+00	6.79E+00	6.79E+00	6.79E+00	6.79E+00	6.79E+00	6.79E+00	6.79E+00	6.79E+00
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

*Priority Contaminants

PROCESS

EX-SITU CO/S - TANK V-2 AND V-9

Installation of ancillary and support systems including, reaction vessel, AEA mixer, Instrument Probe bundle, Off-gas Treatment system, and Sodium Hydroxide and Reagent (oxidant) lines etc.

- C Pump contents of tank V-2 and V-9 into reaction vessel
- Start continuous tank agitation.
- 5 Initiate reaction vessel agitation and heat tanks contents to 80C
- 6 Add 20% Sodium Hydroxide solution to bring reaction vessel contents to pH 12
- Maintain temperature and agitation to facilitate "heat soak" pretreatment.
- 7 Add stoichiometric amount of sodium persulfate to initiate oxidation.
- Monitor initial reaction progress by pH probe.
- 8 Add stoichiometric amount of sodium persulfate to further oxidation.
- Monitor further reaction progress by pH probe.
- 9 Add stoichiometric amount of sodium persulfate to complete oxidation.
- Monitor final reaction progress by pH probe.
- Verify critical COC concentrations through sampling and analysis
- 10 Adjust reaction tank contents to pH 10.5/Cool to 70F
- 11 Pump oxidized liquids from reaction vessel to grout mixer/extruder
- E Grout oxidized liquid waste
- F Extrude and containerized grouted waste into 55 gallons drums
- Grout sample collection and analysis for compliance evaluation.
- 1 Tank V-2 and V-9 excavation, retrieval and transporation to ICDF Landfill
- Dismantle ancillary and support systems and transport to ICDF for disposal.
- 2 Excavate surrounding contaminated soil and transport to ICDF for disposal
- 3 Fill tanks V-2 and V-9 with grout. at ICDF and dispose of tanks.

ASSUMPTIONS

Empty tanks V-2 and V-9 can be readily extracted and transported to ICDF
 Grouting to fill tanks V-2 and V-9 will be done at the ICDF
 50% NaOH solution specific gravity of 1.50
 TCE total DRE of 99.5% with 60%, 30%, 10% of it occurring in steps 18, 19, 20 respectively
 PCE total DRE of 99.1% with 60%, 30%, 10% of it occurring in steps 18, 19, 20 respectively
 VOC & Bis(2-ethylhexyl) phthalate total DRE of 90% with 60%, 30%, 10% occurring in steps 18, 19, 20 respectively
 Arochlor total DRE of 50% with 60%, 30%, 10% of it occurring in steps 18, 19, 20 respectively
 SVOC and TOC total DRE of 70% with 60%, 30%, 10% of it occurring in steps 18, 19, 20 respectively
 If Petroset is used it will be used at a rate of 8 lbs. per gallon of waste liquid
 Bulk density of tanks is arbitrarily assumed to be 1.2 g/ml
 Assumes the use of a 28w% solution of sodium persulfate at room temperature
 Following oxidation and prior to final pH adjust that liquid contents have no buffering capacity remaining
 If cementitious grout is used it will be applied to achieve a 0.45 waste water/dry cement ratio by weight
 If cementitious grout is used the resulting wet density will be 1.72 g/cc
 SVOCs contain no chloride content
 VOCs contain an average of 85w% chloride
 That the oxidized and pH adjust liquid residuals can be successfully grouted to obtain a compressive strength meeting ICDF WAC requirement
 A 35,000 fold decrease in Mercury Concentration between grouted Mercury concentration and TCLP results

MATERIAL BALANCE VARIABLES

Bulk Density of Tank Waste	1.2
50w% NaOH solution density	1.5
First Ph adjust volumetric expansion (%)	0.4
28w% Na Persulfate solution density	1.14
First Reagent volumetric expansion (%)	20
Total SVOC DRE (%)	70
Total PCB DRE (%)	50
Total bis(2-ethylhexyl) phthalate DRE (%)	90
Total VOC DRE (%)	90
Total PCE DRE (%)	99.1
Total TCE DRE (%)	99.5
Total TOC DRE (%)	70
Second Reagent volumetric expansion (%)	10
Final Reagent volumetric expansion (%)	10
Waste Liquid/Dry Cement Mass Ratio	0.45
Wet Grout Density	1.72
w% cl in VOCs	0.85
w% cl in SVOCs	0
w% cl in Arochlor	0.608

EX-SITU CO/S - TANK V-2 AND V-9

MATERIAL BALANCE

Initial Tank Contents	pH adjust/heat soak		first reagent add		second reagent add		final reagent add		pH grout adjust/Cooling grout		
	End of	7	8	End of	8	9	End of	9	10	11	12
Temperature C	12.7	80	80	80	80	80	80	80	80	21.1	12
pH	7.5	12	7	7	7	7	7	7	7	21.1	
Relative time (hrs)	0	4	6.4	7	7	7	7	7	7	10.5	
Total Volume (L)	7250	7279	8735	8735	8735	8735	8735	8735	8735	268	
w% solids	10.29	NA	NA	NA	NA	NA	NA	NA	NA	268	
Total Mass (kg)	8700	8744	10403	10403	10403	10403	10403	10403	10403	10197	22617
Antimony (kg) (+/-3,+/-5)	4.77E-02	4.77E-02	4.77E-02	4.77E-02	4.77E-02	4.77E-02	4.77E-02	4.77E-02	4.77E-02	4.77E-02	4.77E-02
Barium (kg) (+2)	6.28E-01	6.28E-01	6.28E-01	6.28E-01	6.28E-01	6.28E-01	6.28E-01	6.28E-01	6.28E-01	6.28E-01	6.28E-01
Beryllium (kg) (+2)	5.22E-02	5.22E-02	5.22E-02	5.22E-02	5.22E-02	5.22E-02	5.22E-02	5.22E-02	5.22E-02	5.22E-02	5.22E-02
Cadmium (kg) (+2)	2.35E-01	2.35E-01	2.35E-01	2.35E-01	2.35E-01	2.35E-01	2.35E-01	2.35E-01	2.35E-01	2.35E-01	2.35E-01
Chromium (kg) (+2,+3,+6)	9.29E+00	9.29E+00	9.29E+00	9.29E+00	9.29E+00	9.29E+00	9.29E+00	9.29E+00	9.29E+00	9.29E+00	9.29E+00
Cyanide (kg) (-1)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Lead (kg) (+2,+4)	2.44E+00	2.44E+00	2.44E+00	2.44E+00	2.44E+00	2.44E+00	2.44E+00	2.44E+00	2.44E+00	2.44E+00	2.44E+00
Mercury (kg) (+1,+2)	4.49E+00	4.49E+00	4.49E+00	4.49E+00	4.49E+00	4.49E+00	4.49E+00	4.49E+00	4.49E+00	4.49E+00	4.49E+00
Nickel (kg) (+2,+3)	8.86E-01	8.86E-01	8.86E-01	8.86E-01	8.86E-01	8.86E-01	8.86E-01	8.86E-01	8.86E-01	8.86E-01	8.86E-01
Silver (kg) (+1)	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Transuranics (Ci)*	1.29E-01	1.29E-01	1.29E-01	1.29E-01	1.29E-01	1.29E-01	1.29E-01	1.29E-01	1.29E-01	1.29E-01	1.29E-01
Cesium-137 (Ci)* (+1)	2.71E+01	2.71E+01	2.71E+01	2.71E+01	2.71E+01	2.71E+01	2.71E+01	2.71E+01	2.71E+01	2.71E+01	2.71E+01
Strontium-90 (Ci) (+2)	2.63E+01	2.63E+01	2.63E+01	2.63E+01	2.63E+01	2.63E+01	2.63E+01	2.63E+01	2.63E+01	2.63E+01	2.63E+01
SVOCS (kg)	1.77E+00	1.77E+00	1.77E+00	1.77E+00	1.77E+00	1.77E+00	1.77E+00	1.77E+00	1.77E+00	1.77E+00	1.77E+00
Arochlor 1260 (kg)*	3.96E-01	3.96E-01	3.96E-01	3.96E-01	3.96E-01	3.96E-01	3.96E-01	3.96E-01	3.96E-01	3.96E-01	3.96E-01
bis (2-ethylhexyl) phthalate	8.12E+00	8.12E+00	8.12E+00	8.12E+00	8.12E+00	8.12E+00	8.12E+00	8.12E+00	8.12E+00	8.12E+00	8.12E+00
VOCs (kg)	2.59E+00	2.59E+00	2.59E+00	2.59E+00	2.59E+00	2.59E+00	2.59E+00	2.59E+00	2.59E+00	2.59E+00	2.59E+00
Tetrachloroethylene (kg)	1.40E+00	1.40E+00	1.40E+00	1.40E+00	1.40E+00	1.40E+00	1.40E+00	1.40E+00	1.40E+00	1.40E+00	1.40E+00
Trichloroethylene (kg)	1.93E-01	1.93E-01	1.93E-01	1.93E-01	1.93E-01	1.93E-01	1.93E-01	1.93E-01	1.93E-01	1.93E-01	1.93E-01
TOC (kg)*	3.16E+02	3.16E+02	3.16E+02	3.16E+02	3.16E+02	3.16E+02	3.16E+02	3.16E+02	3.16E+02	3.16E+02	3.16E+02
chlorides (kg)*	4.56E+01	4.56E+01	4.56E+01	4.56E+01	4.56E+01	4.56E+01	4.56E+01	4.56E+01	4.56E+01	4.56E+01	4.56E+01
carbon dioxide	0	0	0	0	0	0	0	0	0	0	0
*Priority Contaminants											
chloride concentration (mg/l)	6289.655172	6264.596785	5220.497321	5220.497321	5220.497321	5220.497321	5220.497321	5220.497321	5220.497321	5220.497321	5220.497321
			6514.334603	6514.334603	6514.334603	6514.334603	6514.334603	6514.334603	6514.334603	6514.334603	6514.334603
			6013.231941	6013.231941	6013.231941	6013.231941	6013.231941	6013.231941	6013.231941	6013.231941	6013.231941
			6610.387609	6610.387609	6610.387609	6610.387609	6610.387609	6610.387609	6610.387609	6610.387609	6610.387609
			6138.217066	6138.217066	6138.217066	6138.217066	6138.217066	6138.217066	6138.217066	6138.217066	6138.217066
			6323.050963	6323.050963	6323.050963	6323.050963	6323.050963	6323.050963	6323.050963	6323.050963	6323.050963
			2848.989193	2848.989193	2848.989193	2848.989193	2848.989193	2848.989193	2848.989193	2848.989193	2848.989193

*Priority Contaminants

PROCESS

EX-SITU CO/S - TANK V-3

Installation of ancillary and support systems including, reaction vessel, AEA mixer, Instrument Probe bundle, Off-gas Treatment system, and Sodium Hydroxide and Reagent (oxidant) lines etc..

- C Pump contents of tank V-1 into reaction vessel
- Start continuous tank agitation.
- 5 Initiate reaction vessel agitation and heat tanks contents to 80C
- 6 Add 20% Sodium Hydroxide solution to bring reaction vessel contents to pH 12
- Maintain temperature and agitation to facilitate "heat soak", pretreatment.
- 7 Add substoichiometric amount of sodium persulfate to initiate oxidation.
- Monitor initial reaction progress by pH probe.
- 8 Add substoichiometric amount of sodium persulfate to further oxidation.
- Monitor further reaction progress by pH probe.
- 9 Add substoichiometric amount of sodium persulfate to complete oxidation.
- Monitor final reaction progress by pH probe.
- Verify critical COC concentrations through sampling and analysis
- 10 Adjust reaction tank contents to pH 10.5/Cool to 70F
- 11 Pump oxidized liquids from reaction vessel to grout mixer/extruder
- E Grout oxidized liquid waste
- F Extrude and containerized grouted waste into 55 gallons drums
- Grout sample collection and analysis for compliance evaluation.
- 1 Tank V-3 excavation, retrieval and transportation to ICDF Landfill
- Dismantle ancillary and support systems and transport to ICDF for disposal.
- 2 Excavate surrounding contaminated soil and transport to ICDF for disposal
- 3 Fill tank V-3 with grout at ICDF and dispose of tank.

ASSUMPTIONS

6,000 gallons of supernate liquid will be decanted from tank V-3 prior to tank remediation
 Empty tank V-3 can be readily extracted and transported to ICDF
 Grouting to fill tank V-3 will be done at the ICDF
 50% NaOH solution specific gravity of 1.50
 TCE total DRE of 99.5% with 60%, 30%, 10% of it occurring in steps 28,29, 30 respectively
 PCE total DRE of 99.1% with 60%, 30%, 10% of it occurring in steps 28,29, 30 respectively
 VOC & Bis(2-ethylhexyl) phthalate total DRE of 90% with 60%, 30%, 10% occurring in steps 28, 29, 30 respectively
 Arochlor total DRE of 50% with 60%, 30%, 10% of it occurring in steps 28,29, 30 respectively
 SVOC and TOC total DRE of 70% with 60%, 30%, 10% of it occurring in steps 28,29, 30 respectively
 If Petrosel is used it will be used at a rate of 8 lbs. per gallon of waste liquid
 Bulk density of tanks is arbitrarily assumed to be 1.2 g/ml
 Assumes the use of a 28w% solution of sodium persulfate at room temperature
 Following oxidation and prior to final pH adjust that liquid contents have no buffering capacity remaining
 If cementitious grout is used it will be applied to achieve a 0.45 waste water/dry cement ratio by weight
 If cementitious grout is used the resulting wet density will be 1.72 g/cc
 SVOCs contain no chloride content
 VOCs contain an average of 85w% chloride
 That the oxidized and pH adjust liquid residuals can be successfully grouted to obtain a compressive strength meeting ICDF WAC requirement
 A 10,000 fold decrease in Mercury Concentration between grouted Mercury concentration and TCLP results

MATERIAL BALANCE VARIABLES

Bulk Density of Tank Waste	1.2
50w% NaOH solution density	1.5
First Ph adjust volumetric expansion (%)	0.4
28w% Na Persulfate solution density	1.14
First Reagent volumetric expansion (%)	20
Total SVOC DRE (%)	70
Total PCB DRE (%)	50
Total bis(2-ethylhexyl) phthalate DRE (%)	90
Total VOC DRE (%)	90
Total PCE DRE (%)	99.1
Total TCE DRE (%)	99.5
Total TOC DRE (%)	70
Second Reagent volumetric expansion (%)	10
Final Reagent volumetric expansion (%)	10
Waste Liquid/Dry Cement Mass Ratio	0.45
Wet Grout Density	1.72
w% cl in VOCs	0.85
w% cl in SVOCs	0
w% cl in Arochlor	0.608

EX-SITU CO/S - TANK V-3

MATERIAL BALANCE

Initial Tank Contents	pH adjust/heat soak		first reagent add		second reagent add		final reagent add		pH grout adjust/Cooling grout		
	End of	7	8	End of	9	10	End of	10	11	12	
Temperature C	12.7	80	80	80	80	80	80	80	21.1	21.1	21.1
pH	7.5	12	7	7	4	4	4	2	10.5	10.5	10.5
Relative time (hrs)	0	4	124	125.1	197.1	244	244	268	364	364	364
Total Volume (L)	8706	8741	10489	10489	11363	11363	11363	12237	12245	12245	27159
w% solids	11.06 NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Mass (kg)	10447	10499	12492	12492	13489	13489	13489	14485	14497	14497	46714
Antimony (kg) (+/-3,+/-5)	3.02E-02	3.02E-02	3.02E-02	3.02E-02	3.02E-02	3.02E-02	3.02E-02	3.02E-02	3.02E-02	3.02E-02	3.02E-02
Barium (kg) (+2)	3.62E-01	3.62E-01	3.62E-01	3.62E-01	3.62E-01	3.62E-01	3.62E-01	3.62E-01	3.62E-01	3.62E-01	3.62E-01
Beryllium (kg) (+2)	4.69E-02	4.69E-02	4.69E-02	4.69E-02	4.69E-02	4.69E-02	4.69E-02	4.69E-02	4.69E-02	4.69E-02	4.69E-02
Cadmium (kg) (+2)	2.02E-01	2.02E-01	2.02E-01	2.02E-01	2.02E-01	2.02E-01	2.02E-01	2.02E-01	2.02E-01	2.02E-01	2.02E-01
Chromium (kg) (+2,+3,+6)	8.12E-01	8.12E-01	8.12E-01	8.12E-01	8.12E-01	8.12E-01	8.12E-01	8.12E-01	8.12E-01	8.12E-01	8.12E-01
Cyanide (kg) (-1)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Lead (kg) (+2,+4)	2.29E+00	2.29E+00	2.29E+00	2.29E+00	2.29E+00	2.29E+00	2.29E+00	2.29E+00	2.29E+00	2.29E+00	2.29E+00
Mercury (kg) (+1,+2)	2.93E+00	2.93E+00	2.93E+00	2.93E+00	2.93E+00	2.93E+00	2.93E+00	2.93E+00	2.93E+00	2.93E+00	2.93E+00
Nickel (kg) (+2,+3)	7.50E-01	7.50E-01	7.50E-01	7.50E-01	7.50E-01	7.50E-01	7.50E-01	7.50E-01	7.50E-01	7.50E-01	7.50E-01
Silver (kg) (+1)	2.19E-01	2.19E-01	2.19E-01	2.19E-01	2.19E-01	2.19E-01	2.19E-01	2.19E-01	2.19E-01	2.19E-01	2.19E-01
Transuranics (Ci)*	8.36E-02	8.36E-02	8.36E-02	8.36E-02	8.36E-02	8.36E-02	8.36E-02	8.36E-02	8.36E-02	8.36E-02	8.36E-02
Cesium-137 (Ci) (+1)	2.23E+01	2.23E+01	2.23E+01	2.23E+01	2.23E+01	2.23E+01	2.23E+01	2.23E+01	2.23E+01	2.23E+01	2.23E+01
Strontium-90 (Ci) (+2)	4.72E+01	4.72E+01	4.72E+01	4.72E+01	4.72E+01	4.72E+01	4.72E+01	4.72E+01	4.72E+01	4.72E+01	4.72E+01
SVOCS (kg)	4.57E-02	4.57E-02	2.65E-02	2.65E-02	2.65E-02	2.65E-02	2.65E-02	2.65E-02	2.65E-02	2.65E-02	2.65E-02
Arochlor 1260 (kg)*	4.60E-01	4.60E-01	3.22E-01	3.22E-01	3.22E-01	3.22E-01	3.22E-01	3.22E-01	3.22E-01	3.22E-01	3.22E-01
bis (2-ethylhexyl) phthalate	1.37E+01	1.37E+01	6.30E+00	6.30E+00	6.30E+00	6.30E+00	6.30E+00	6.30E+00	6.30E+00	6.30E+00	6.30E+00
VOCs (kg)	1.45E-03	1.45E-03	6.65E-04	6.65E-04	6.65E-04	6.65E-04	6.65E-04	6.65E-04	6.65E-04	6.65E-04	6.65E-04
Tetrachloroethylene (kg)	1.14E+00	1.14E+00	4.63E-01	4.63E-01	4.63E-01	4.63E-01	4.63E-01	4.63E-01	4.63E-01	4.63E-01	4.63E-01
Trichloroethylene (kg)	1.26E-03	1.26E-03	5.07E-04	5.07E-04	5.07E-04	5.07E-04	5.07E-04	5.07E-04	5.07E-04	5.07E-04	5.07E-04
TOC (kg)*	3.45E+02	3.45E+02	2.00E+02	2.00E+02	2.00E+02	2.00E+02	2.00E+02	2.00E+02	2.00E+02	2.00E+02	2.00E+02
chlorides (kg)*	1.94E+00	1.94E+00	2.61E+00	2.61E+00	2.61E+00	2.61E+00	2.61E+00	2.61E+00	2.61E+00	2.61E+00	2.61E+00
carbon dioxide	0	0	5.31E+02	5.31E+02	5.31E+02	5.31E+02	5.31E+02	5.31E+02	5.31E+02	5.31E+02	5.31E+02
*Priority Contaminants											
chloride concentration (mg/l)	222.8348266	221.9470384	184.9558653	248.4797277	229.3659025	258.6846083	240.2071362	249.2819737	249.1174967	112.3194567	

0.000124
0.00179

4.332018963 Cd TCLP
62.63453224 Hg TCLP
1.788613215
4.923983637
28.32755301